

July

This Issue 307,000 -

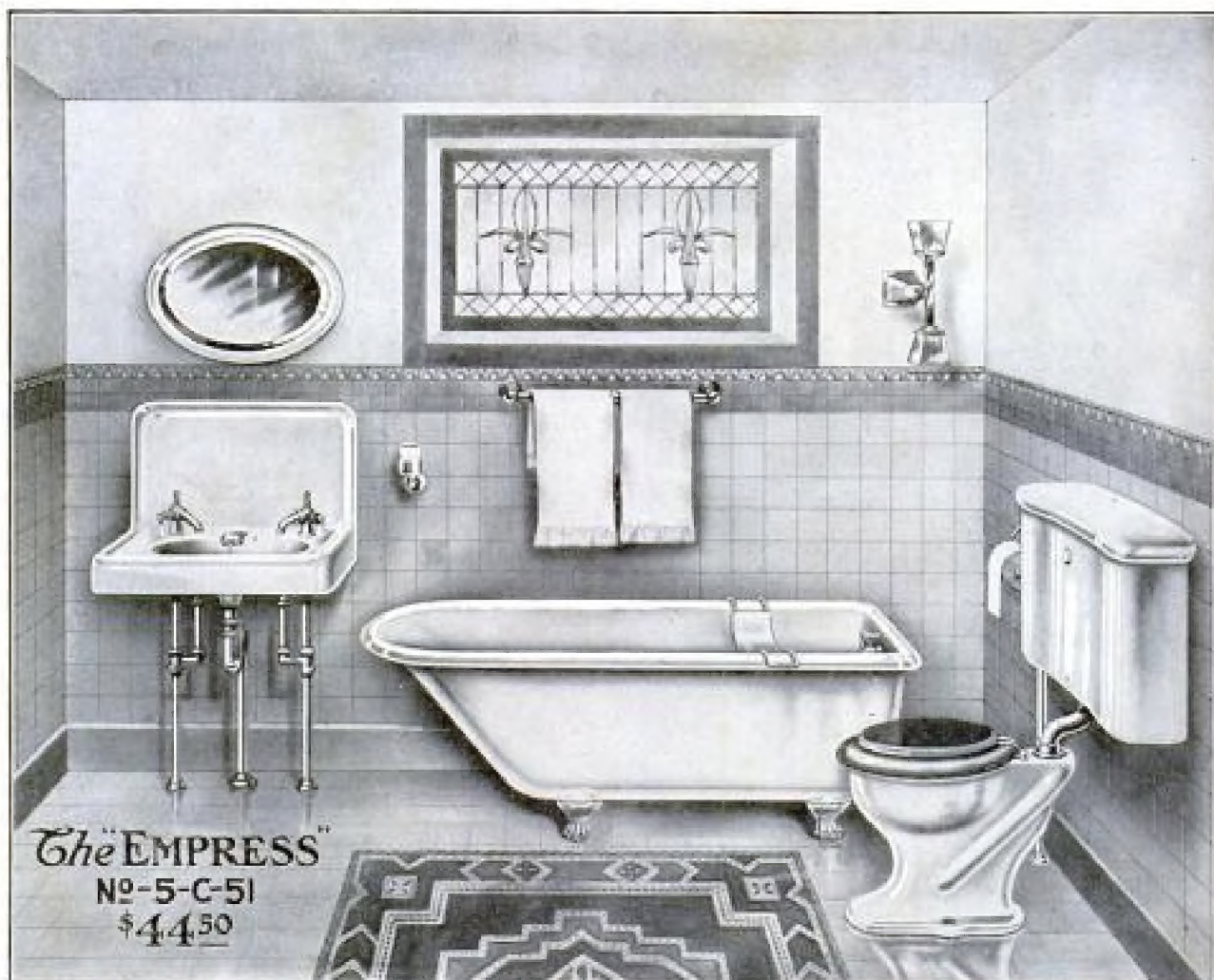
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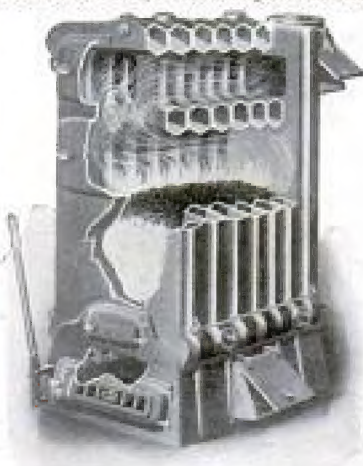
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539

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**An honorable discharge from the Navy is
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☐ Send for the Navy's booklet, "The Making of a Man-O'-Warsman," fully illustrated, describing life in the naval service. **FREE** if you request it. Just tear off this coupon and paste it on a post card.

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Popular Mechanics Magazine

318 W. Washington Street, Chicago, U. S. A.

EDITED BY H. H. WINDSOR

ISSUED MONTHLY

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Entered as Second Class Matter Sept. 15, 1911, at the Postoffice at Chicago, Illinois, under Act of March 3rd, 1879.

Published monthly by POPULAR MECHANICS CO.

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The attention of prospective advertisers is called to the policy of this magazine in accordance with which the publisher waives all claim for payment of any advertisement appearing in any issue where the number of copies actually printed and circulated is less than the number printed on the front cover page.

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Would You Give \$12 to Learn the Auto Trade

AS CHAUFFEUR, REPAIRMAN, SALESMAN OR EXPERT?



Of course you would, if we could prove it. A camera picture only what exists, so here's a photo engraving of one of our students who is making money and his investment represents only \$12. Below is the name and address of this man.

I give your course credit for having started me in the auto repair business. I do repair work for auto owners. The enclosed photo shows a job I am doing for Mr. Frank Schell at his home on his Overland car. I make a specialty of grinding valves and overhauling cars and always have work ahead. I sometimes buy used cars and overhaul them to sell. I am now making preparations to go into the business on a larger scale and take the agency for a car. Hoping this letter will be of service to you, I remain, yours gratefully.
E. A. LAMB, proprietor of Lamb's Auto Shop,
1221 Buchanan Street, Moberly, Mo.
(Feb. 12, 1912.)

Why Such Results

Such success is not the result of a mere correspondence course. The Dyke system is that, but a great deal more in addition. Mr. Frederick Marwick of Scranton, Pa., said, "As a practical man, I find in your models the real key to teaching by mail." And he hit it exactly right. Our

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Harry J. Herbin, Jamestown, Kans., was a farmer, but has doubled his income repairing and selling autos.
W. R. McClelland, Astoria, Ill., was an auto driver. Became professional chauffeur and more than doubled his salary.
Donald Stewart, Oakland City, Ind., became a chauffeur at \$25 a week.
B. M. Fawcett and S. T. Slayback, both graduates, are now running a Garage and Repair Shop at Woodbine, Iowa.
And we could continue until we had filled this and several more pages.

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You can obtain the same start these men had—all the help and more, because we have just brought the instruction up to date, enlarged the books, added a new manikin of the assembly of the auto and the power plant. None of these men had the help of

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This represents years of work to provide something that no other school had, namely, a way for the graduate to get acquainted with auto and garage owners, to prove his ability and to immediately secure profitable employment.

Mr. Dyke has been identified as a pioneer inventor, supply man, etc., with the auto industry since its beginning. He originated the first Auto Supply Co. and published the first book on autos in America. No other man with such experience is today teaching others. And all the experience and inside information of the auto business he has thus gained, is embodied in this Employment Plan. If these men whose endorsement are here given, could make so much money out of this System without other help, think how much more you should do with the assistance of this Employment Plan.

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This is a chance you may never have again to get into the fastest growing, best paying industry the world has ever known, a field that is growing faster than men can qualify for the work.

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Until further notice in this magazine the Editor of Popular Mechanics will pay two cash prizes each month for the best original contributions to its

SHOP NOTES DEPARTMENT

\$10 for the Best Contribution
\$5 for the Second Best

THIS IS IN ADDITION to our usual rates for such contributed articles.

Quality, not length counts.

Checks will be sent on the last day of each month for the prize articles received during that month. Publication in the magazine will follow in about two months.

PRIZES AWARDED FOR MAY, 1912

First Prize—JAMES McCaffrey, Pawtucket, R. I. \$10
"Auxiliary Gasoline Tank for an Automobile"
Second Prize—S. H. PACKARD, Boston, Mass. \$5
"Handle Shapes for Wheelbarrows"

EXTRA AWARD

On account of there being five contributions this month each of which deserved second prize, we have made an EXTRA AWARD of four additional second prizes, as follows:

P. H. TIERNEY, Lynn, Mass. \$5
"Double-Blade Hack Saw Frame"
EDWARD MATTHEWS, New York. \$5
"To Make Worn Threads of a Bolt Hold"
JAMES F. NAPIER, Montreal. \$5
"Balancer Design to Fit Any Pitch of Stairway"
R. F. POHLE, E. Lynn, Mass. \$5
"Ink Fountain for Covering Large Surfaces on Drawings"

All accepted contributions to our departments, "SHOP NOTES" and "AMATEUR MECHANICS," are paid for immediately; checks for prize awards are sent at the end of each month.

Address, EDITOR POPULAR MECHANICS
318 W. Washington St., Chicago



ARE YOU A MIND WANDERER?



A YOUNG MAN was recently selected for promotion to the managership of his firm's Pacific Coast branch. At a directors' meeting he was called in and introduced by the President. Twelve pairs of sharp eyes took his measure. His personality was distinctive. The first impression was a favorable one.

"How much business did we do on the Coast last year," he was asked by the Chairman.

"About,—er—well, I can't exactly remember," was the answer.

Another man whose memory was better got the position.

Now Memory is not a Gift, it is an Accomplishment. You are not born with a good or a bad memory. You are endowed with latent powers, it rests with you whether you let them lie dormant—or develop them to the degree that will make you a man way above the Common Herd. The big men everywhere, in Business, Science, Religion, Literature, Law or any other vocation are the ones

who have developed their powers of Concentration, Attention, and Retention. Their minds are not garbaged with rambling, unrelated, disconnected ideas. They have learned to direct and control their thoughts, and so can you.

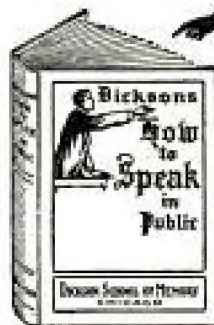
Memory Training is not for a select few, it is for YOU. Let this thought encourage you, that YOU can attain your highest aims if you wish. HOW? Write NOW for my free booklet, "How to Remember," using coupon below, or drop a postal card.



Prof. Henry Dickson

America's foremost authority on Memory Training, Public Speaking, Self Expression, and Principal of the Dickson Memory School, Auditorium Building, Chicago.

Do luxe edition handsomely illustrated, richly bound. Is exactly suited to meet the needs of the man or woman who desires to be a successful public speaker. The price of this 1911 de luxe edition is \$2.00. I will, however, present a copy absolutely FREE to every student who enrolls for my course of memory training within ten days after reading this offer.



How to get a FREE copy of this book

PROF. HENRY DICKSON

Principal, Dickson School of Memory
705 Auditorium Bldg., CHICAGO, ILL.

Send me free Booklet, "How to Remember," also full particulars how to obtain a free copy of "Dickson's How to Speak in Public."

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Street _____

City _____

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Classified Advertisements

Advertisements in this section, 10 cents per word, each insertion, minimum 10 words, payable in advance. To insure ads being inserted under proper classified head in the August issue, copy must reach this office not later than July 1st.

Popular Mechanics Magazine, Chicago, Ill.

Gentlemen: Replying to your favor of the 23rd inst., regarding advertising recently sent you by the writer for The Southern Typewriter Sales Company, I wish to state that this advertising came near getting us in trouble—it is a terrible thing to get "swamped" with letters, especially when one man has to be the whole works, such as it is in this case. I have no stenographer, but had the ad continued another month I fear I would have employed one.

The ad was indeed satisfactory so far as replies to same are concerned. I believe I received 150 letters, and they are still coming in at this late date, which proves to me that your magazine, "Popular Mechanics," is not glanced at and discarded, but is constantly read thoroughly. I have made a couple of sales so far and believe should make several more. One thing sure, the ad has served me well.

Rest assured you will be favored with another ad in the near future, and it is very likely that I will give you a larger ad next time and will continue to let same run.

Thanking you for your prompt attention and wishing you every possible success, I am,
Very truly yours, V. D. LIGGETT, Tyler, Texas.

AUTOMOBILES

LOOK—Closing out—8 hp. Oldsmobile Runabout, \$120; 12 hp. Cadillac Runabout, \$165; 14 hp. Autocar Runabout, \$185; 18 hp. Ford Touring Model, \$270. Everyone in excellent condition. Here's your chance to get a good car cheap. Address Ties, L. Williams, Cincinnati, Fla.

1907 WHITE Steamer, perfect running order, paint good, five good tires worth \$75, extras worth \$50, all for \$135. Money refunded if not as represented. Demonstration given. Columbia Poultry Yards, Toms River, N. J.

FORD Sale—Axles, wheels, steering gear, new transmission from Premier car. Fine condition. Cheap. Also used large steering gear and radiator. Cut prices on motors, axles and transmissions. F. E. Alford, Goshen, Ind.

AUTOMOBILES: Biggest bargains ever offered; send for list and prices. D. M. Brown, 114 3rd St. South, Minneapolis, Minnesota.

FORD owners wanting fine electric lights available anytime, using Ford magneto for charging a storage battery (self contained system). Write American Battery Company, 1129 Fulton St., Chicago.

2 TON truck chassis less motor, \$75. Pugh, 584 Mass. Ave., Buffalo, N. Y.

SIX, eight and ten hundred capacity New 1914 Kearns delivery cars sold three. Solid tire runabouts from \$275 to \$450. One 1910 Middleclass 30 H. P. 4 cylinder taxicab like new \$500. Eureka Auto Co., Beaverstown, Pa.

FORD Sale—5 pass. Buick auto. Full equipment. Just overhauled and painted. \$250. Well worth more. Earl Ensign, Silver Lane, Conn.

AUTOMOBILE instructions, four weeks' course covering shop and road work—provision for out-of-town men. Send for booklet. P. M. West Side Y. M. C. A. Automobile School, 318 West 37th St., New York, N. Y.

AUTOMOBILE owners, get an Elder Power-transmission; make your automobile run your machinery. Agents wanted, Elder Manufacturing Co., Indianapolis, Indiana.

IMPROVEMENTS in Automobiles and parts wanted; send sketch. Sanders, 37 Cordly Block, Chicago.

FORD Sale—Metz automobile, fine condition. New tires, electric lights, magneto, speedometer. \$235. Ray Ellis, Arkansas City, Kansas.

AUTOMOBILE—31 h. p.; as good as new; price \$425, 58 E. Second St., Covington, Ky.

SIMPLEST way on earth to time automobile engine, 25c. "Strong," Homer, Mich.

"THE How and Why of the Automobile"—A 200-page book of practical information for seekers after the fundamental facts regarding the gasoline engine and its application to the motor car. Interesting and instructive to both the beginner and the expert. Bound in full cloth—250 illustrations. Price \$1.00 postpaid. Popular Mechanics Book Dept., Chicago.

AUTOMOBILES. Sacrifice sale on new and used cars. Box 275, Burlington, Wis.

STEAM car owners. Myers Kerosene Burner, something new; write for circular. 187 Osceola Street, Denver, Colo.

SEE what we say under "Patents." Swift, Attorney, Washington, D. C.

AUTOMOBILE model. Every part shown and named. You can to all intents and purposes take off the wheels, raise the hood and remove the body; exposing to view the vital parts. The only practical method of studying the automobile. Price 50 cents postpaid. Popular Mechanics Book Dept., Chicago.

A. C. C. A. Prices Talk! Spring sale is on! Hundreds of runabouts, jacy roadsters, five and seven passenger touring cars—elegantly and completely equipped! Guaranteed five years! Freight prepaid! We offer 29 runabouts formerly cost \$500 to \$1,000, now \$30 up! 18 roadsters, three and four passenger, formerly cost \$1,000 to \$2,000, now \$175 up! 38 touring cars, five, six and seven passenger, formerly cost \$1,500 to \$5,000, now \$200 up! All best American and Foreign makes, such as Packards, Pierce Arrows, Stevens, Wintons, Standard Dayton, Peerless, Stearns, Pope Harfords, Locomobiles, White, Remonts, Buicks, Maxwells, Fords, etc., etc. Write today for our Illustrated Catalog, the largest and most complete list of its kind ever published! The Automobile and Cycle Company of America, Dept. C, 1769-1787 Broadway, New York City.

TWO automobiles and portable garage sacrificed! One Oldsmobile "30-35" horsepower, luxurious five-passenger touring, four doors. Equipment includes everything. Cost nearly \$2,000. For quick sale \$400. One Autocar runabout (doctors model), top, windshield and full equipment, \$225. Fireproof portable garage \$25. Two barrels oil, \$30. Shonhard, 246 Lenox Ave., New York City.

SAVE middlemen's profits. Buy from factory distributor. Electric horns, complete, \$15, prepaid. Penetrating warning. Clear road. J. H. Rose, Omaha, Neb.

1911 METZ \$225, or trade for screw-cutting lathe and cash. Chas. B. Old, Ann Arbor, Mich.

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TIRE Specials. Guaranteed Tires. 1912 fresh stock; just bought an entire surplus stock. Order today while they last: 28x3—\$8.00, Tube, \$2.40; 30x3—\$9.00—\$2.53; 30x3½—\$12.55—\$3.55; 32x3½—\$14.25—\$4.00. Other sizes, prices in proportion. Write for complete list. We ship C. O. D. subject to examination upon receipt of express charges. Para Auto Tire Co., 1425 Michigan Ave., Chicago, Ill.

PELLET'S Magneto Exchange, 1463 Michigan Ave., Chicago. All makes bought, sold, exchanged, repaired and remagnetized. Repairs guaranteed. Parts and coils in stock for all makes of magnetos. Agents for Elsmann Magneto Co., Connecticut Telephone & Electric Co., Atwater Kent Unispark, Gray & Davis Lighting System.

AUTO guaranteed tires. 28x3 \$8.85, tube \$2.75; 30x3 \$10.50, tube \$2.85; 30x3½ \$14.95, tube \$3.75; 32x3½ \$15.75, tube \$4.25; 32x4 \$21.15, tube \$5.00; 34x4 \$22.25, tube \$5.15. These tires are all No. 1 free from flaws or blemishes. They have the white tough tread. I am getting orders from customers that have used them; the kind I want to sell. I ship on receipt of 10% amount of order and allow examination. Send for complete list. Vanderpool's, Springfield, Ohio.

24 H. P. four cylinder engine and auto running gears \$160, or trade 1911 motor cycle. R. Beckhaus, Halstead, Kan.

AUTOMOBILE cylinders reground, new pistons and rings fitted. Garage air compressors. Cast Iron Brazing Co., Manchester, N. H.

NEW tires. 28x3, \$7.85; 30x3, \$8.75; 30x3½, \$11.75; 32x3½, \$12.50. Other sizes accordingly. Get latest price bulletin. 10% with order; balance C. O. D. Examination allowed. Auto Tire Brokerage Company, 1355 Michigan Ave., Chicago.

WE make a better unguaranteed Automobile Tire than most guaranteed ones. You get exactly what you pay for. Gums, Fabrics and Mechanical goods. National Company, 1490 Clybourn Place, Chicago, Ill.

TIRES, all makes, all guaranteed, 28x3½, \$4.50; 30x3, \$6; 30x3½, \$13. Write for our complete list of tires and tubes before purchasing. We ship C. O. D. Guarantee Tire Company, Dept. M, 230-232 West 135 St., N. Y. City.

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HERE'S one that's different. If you're a good square man in unoccupied territory. I will send you, without the usual deposit, without the payment of a cent except express charges, a sample Standup Scribbler. In a few salesmen's case, and give you exclusive territorial rights for the sale of the best hand-drawing machine now on the market. Refers \$1.50, and goes about as fast as they can be handed out. Apply now, state county wanted (not more than one county to an agent) and references, and look for quick and full instructions within a week.—Elmer E. Stevens, Inc., 1180 River St., Aurora, Illinois.

CALIFORNIA red wood clothes chests, better than cedar, 1/2 cost. Heavy 4 feet long with arms for window seat, varnished, built proof, 18.75. Keep fresh red wood bread box 50 cents. Colonial red wood candle sticks 25 cents, 6 \$1.00. Agents sample, no spring no scratch, instant broom holder sells rapidly 10 cents. Utility Products Mfg. Co., Tropic, Calif.

AGENTS—At Once—Something New. "Model Spring Window." Makes springs any size from any kind of spring wire. Rapid, efficient and powerful. Indispensable to every factory, farm, shop, garage, painting office. Attaches to any work-bench in a minute. Sell one, make \$2.50 profit. You can sell 10 a day easy. Let's get going. National Mfg. & Sales Co., 307 Huron St., Toledo, O.

NEW suit offer. Send name and address for wonderful suit offer and outfit to suit, samples, styles, etc. We want live agents. Can make \$1,000 to \$2,000 a year. All business your territory turned over to you. We pay all express charges. Only one suit offer in your town. If you want a suit write quick before someone else gets the prize. Paterson Tailoring Co., Dept. 129V, Chicago, Ill.

AGENTS on salary or commission. The greatest agent's seller ever produced; every user of pen and ink buys it on sight; 200 to 500 per cent profit; one agent's sales amounted to \$620 in six days; another \$32 in two hours. Monroe Mfg. Co., N. O., La. Cross, Wis.

EARN \$15 to \$25 a week or more as our Mail Order Dealer Right from your own home. Hold your position until entire time is required. We are manufacturers and owners of patented mail-order specialties. If you are just starting a Mail Order business or if already established, you can't afford not to handle our Patented Money-Making Goods. We sell exclusively to our Mail Order Dealers. We protect them. We carry stock and furnish everything. No canvassing. Small capital. Experience unnecessary. Write today for Latest Patented Letter and Manufacturers' Best Selling Mail Order specialties plan looked up by "Whole Truth." Presidio Proof and sworn statement, J. M. Pease Mfg. Co., 529 Pease Bldg., Michigan St., Buffalo, N. Y.

AGENTS—\$50 weekly; we manufacture the best needle case made; a wonderful seller; 200 to 500 per cent profit; talking unnecessary; our copyrighted "Trust Scheme" envelopes do the work; general agents can make over \$100 weekly; send 10c for a 25c sample containing 115 needles; particulars free; buy direct from the factory at wholesale. Paty Needle Co., 102 Union Sq., Somerville, Mass.

AGENTS—County and State; men and women everywhere to sell the Pocket-Change Line; a practical later saving invention. Last life-time, sells on sight, gives perfect satisfaction. Agent, Sutton of Georgia, sold over million feet; 100% profit; write quick for exclusive territory; information free; sample postpaid 25c stamps. Pocket-Change Line Company, 329 Wilcox Bldg., Portland, Oregon.

AGENTS—Ladies or gentlemen, to sell the highest grade toilet goods, Coverings, etc., direct to families. High class houses; fair dealing; repeat orders sure; large cash commissions. Address Birmingham Bics., Indianapolis, Ind.

AGENTS—General Agents—Great Wonder Summer Seller. Biggest Summer profit maker ever placed in hands of agents. Patented. Right to season. Not sold by stores. Free sample for demonstration, \$5.00 to \$10.00 a day easily made. Get territory quick. Valuable "Money Making Hint" to agents free. Write today, A. G. McKinley Co., McKinley Bldg., 2175 Ogden Ave., Chicago, Ill.

GREAT suit offer. Write us for starting offer on a suit for yourself, and outfit of samples, styles, etc. Only one suit offer in your town. We want you for agent in your own town over all orders in territory to you. You get big business and easy money. Even now agents make \$10 a week. If you want great suit offer write today or someone may get it first. American Woolen Mills Co., Dept. 110 Y, Chicago.

SALISBURY—Send your name and address to Raymond E. Wood, 500 East Eighth St., Cincinnati, Ohio. I am the manufacturer's Sales Manager for the best household and office electric specialty ever invented. Sell for \$3.50 and \$2.50. Guarantee for credit or deposit required. Capable men only need apply. I want only a few men. The work is permanent, profitable and high-grade. You will be given territory and expected to produce business.

Rite Profits—Easy Money, stamping names and addresses on key chains, umbrella plates, watch fobs, etc. Big demand. We sell blank stock and stamping outfit. Send 10c now for sample with your name on it, and full particulars. Bart Manufacturing Co., 303 E. Duane Street, Brooklyn, N. Y.

500% PROFIT. Your opportunity. Act now. Buyers everywhere for our U. S. Fire Extinguisher. Lowest cost. Quick sales. Exclusive territory given local agents and State Managers. United Mfg. Co., 1201 Jefferson, Toledo, O.

Mail order ads that pay. 20 different proposals fully explained. All bona fide, non-fry Money-getters. Each one the foundation of a successful Mail Order business. Send 10c for full particulars and regular bulletins of new propositions. Mail Dealers Wholesale House, 450 Franklin Bldg., Chicago, Ill.

AGENTS—We manufacture glass paper, plain glass windows made to look like real stain glass; something new; easily applied; big money maker; two sample sheets of paper, with catalogue in colors and discount sheet, for 10c. S. H. Parish & Co., 202 S. Clark St., Chicago.

YOUR sales guaranteed. Sample free to dealers. Men buy on sight. Only device that scientifically lures and stops any 200-old style or safety. Gives correct diagonal stroke. Famous Hobbins' Herring Strap in every machine. Sold on money-back guarantee. 100% profit. Write quick for particulars. Sales Manager, 709 Victor Bldg., Canton, Ohio.

AGENTS are making \$50 a week selling Steel Mantle Lamp and lantern burners. Sample burner mailed to your address for 25c. Particulars free. Steel Mantle Light Co., 329 Huron St., Toledo, O.

YOU can make \$100 as our general or local agent. Household necessity; sales 80 per cent; permanent business; exclusive territory; salary or commission; free sample; credit. J. McKim, 113 Bead St., Newark, N. Y.

AGENTS—If you don't make \$1 profit the first day selling Talc's Best Absorbing Dust Cloths, etc., return samples. Many Agents made \$25. Write quick for particulars. Dept. B-4, Consumers' Direct Supply Co., Boston, Mass.

AGENTS Wanted—Mechanics and shopmen make over \$100 a month in spare time selling transparent handled safety knives and razors. Big profits. Sales easily made. Write for terms today. Novelty Cutlery Co., 67 Mar St., Canton, O.

WANTED—Live Tailoring Agents For Fall. 400 styles of wools, \$50.00 to \$200.00 wholesale. Fit and workmanship guaranteed. Only those who take at least ten orders per season for made-to-measure clothes need apply. My outfits are very elaborate and shipped without expense to you. Business makes big money and establishes permanent business. Exclusive territory. Write today. Harry Sapper, Merchant Tailor, 351 West Quincy Street, Chicago, Illinois.

MAKE 1500% profit selling our sign letters. We'll show you how. 100 varieties. Johnston Co., Quincy, Ill.

500% PROFIT selling our wonderful sign letters for office windows, store fronts and glass signs; resembles finest gold leaf; easily applied; samples free. Metallic Letter Co., 405 N. Clark St., Chicago.

A TWO Minute Demonstration. Makes Every Call a Sale, with large profits. Exclusively honest agents brought out. Free sample and particulars. O. Y. Sales Co., 12-14 Spruce St., New York.

AGENTS—It costs me about \$2.00 to make your name and ship sample machine, but it's a dead sure way of convincing you I've got best household invention on earth. Canvassers and crew mailings make up to \$50.00 a day. Elmer E. Stevens, 1389 Adams Express Bldg., Chicago.

AGENTS make big money selling our new gold letters for office windows, store fronts and glass signs. Any one can run them on. Write today for free sample and full particulars. Metallic Sign Letter Co., 405 N. Clark St., Chicago.

AGENTS—Gasoline Filter for automobiles. Just out. Sells every auto owner. 100% profit. Make \$5.00 every sale. Now hot business wanted. J. H. Abraham Co., 104 Melrose Ave., Toledo, O.

AGENTS & Mail Dealers—Specialties that sell. Big profits. Easy sellers. No canvassing proposition. Success certain. Order pulling circulars furnished. Write for samples. A. S. Macklin & Co., Alexandria, Va.

GREATEST Sensation of the Year! New Invention. Resonator Spark Gap positively eliminates all spark plug troubles; easy to demonstrate; every auto owner buys; agent's make 100% profit. Particulars free. Sample postpaid \$1. Buckeye Auto Accessories Co., Toledo, O.

AGENTS Wanted—Sell Rich Looking Imported 30000 rags, 44 each. R. H. Carter, Miami, Tenn. sold 125 in four days; his profits, \$37. You can do as well. Write for sample offer and unique selling plan; exclusive territory. A. Condon, Rug Importer, Huntington, Maine.

AGENTS make \$30.00 weekly selling our 500 Handy Household Articles; catalogue free. Schoff Co., 1137 Wells St., Chicago.

WE guarantee large weekly income to clever salesman who can handle new patented device for fountain and bars. Sufficient goods given free, paying initial cost. Greatest offer made. Exclusive territory. Fulton-Bell Company, 2 Hector Street, New York.

SALESMEN wanted: A reliable, permanent business, selling Knecht's Combination Kit, the most wonderful tool ever invented. Six pairs drop forged tool steel jaws, one pair handles makes pliers, pliers, punches, wrenches, etc. Invaluable for mechanic, farmer, chauffeur, handy man. Currier-Knecht Mfg. Co., 52 West Street, Coudersport, Pa.

AGENTS, Teachers, Students, here's your opportunity. Sanitary dustless rags. Gem Ironing shoes. Many new household specialties that sell in every house. \$5.00 daily easily made. Now is the time to start and get in on the ground floor. For samples and particulars address Dexter Supply Co., 508 S. Dearborn, Chicago.

NEWEST Pocket pen. Writes with water. Always ready. Easiest seller agents big profit. Sample 25c. Wolff, 4002 Tenthredin, New Orleans.

AGENTS. The New Klean-Eze outfit. The Wonder Worker. 200% profit. Eight combined cleaning utensils. A fortune for live agents. Exclusive territory. Charles Krebs, Secretary, 2268 Archer, Chicago.

AGENTS: To handle Auto specialties; sell on sight. Enclose stamp for particulars. Dept. M, Lewis H. Bailey, Chickasha, Oklahoma.

AGENTS our patented specialties sell like wildfire; send for free catalogue and sample. North 106, Watlington Specialty Co., Dept. D, Westfield, N. J.

AGENTS—Both sexes everywhere to sell our 15 and 25c novelties, orders repeat; big profits. Send for circulars. The Gros and Novelties Mfg. Co., 61 West 125th St., New York City.

I HAVE the greatest money maker on the market; customers delighted; particulars free. H. M., Box 115, Homewood Station, Pittsburgh, Pa.

WE pay the largest commissions, make instant delivery. Guaranteed business, year-round shoes and silk knit neckties, free sample plan. Credit allowed. The Direct Company, 11 South St., Boston, Mass.

45—OUR general and local agents make many dollars. Household necessities—quick repeats—Permanent business—Exclusive territory—Big profits—Free sample. Lee-Pomeroy Co., Box 552, Syracuse, N. Y.

"ALCA," the famous \$5.00 Vacuum Cleaner, seeks a few more willing agents to show its merits and promises prosperity and success in return. Write for gilt-edge proposition. Ala Co., 266 W. 50th St., (Dept. B), New York.

GENERAL Agents and ladies in home towns, the French oak heater and better blower; a fine side line or specialty. Beds and blinds and furniture. Sells on guarantee for 25c. Fine commission, quickly demonstrated, patented. Address with stamp, Mary E. French, Clyde, O.

FREE sample goes with first letter. Something new. Every firm wants it. Orders from \$1 to \$100. Nice, pleasant business. Big demand everywhere. Write at once for free sample and particulars. Mettelle Sales Co., 406 N. Clark St., Chicago.

LIVE agents are earning money with our outfit, which doubles the life of auto tires. Sample outfit \$3. Write us. Steward Specialty Co., Steward, Ill.

AGENTS—100% profit and easy to sell. A splendid opportunity for young men and women to earn \$30.00 or more weekly. Our goods sell on sight, and you can be sure of repeat orders. Liberal proposition to workers. Write now. Velco Corporation Co., Dept. J, Wheeling, W. Va.

AGENTS—Hankama profits and rapid sales with our brand new, seasonable household specialties. Every woman wants several. Write for particulars. Graham Sales Co., Bloomington, Ill.

AGENTS: Our Columbia Folding Hand Bag is the best proposition on the market. Not sold in stores. Big profit. Write for terms and other big sellers. S. V. Diamond, 25 West 21st St., N. Y. C.

MEDALLIONS sell at sight, 90 percent to 500 per cent profit. Make up your own goods and be independent. "It's easy." Catalog free. Fred Rosas Co., 1265 W. Randolph St., Chicago.

OUR specialties sell at sight, experience unnecessary, no trouble to take repeat orders. Catalog sent free. Jess H. Boyd, Dept. 18, Alton, Indiana.

AGENTS—Make \$3 each selling our wonderful luminous enclosures; nothing to sell six a day; absolutely new; shine all night in darkest room. Pioneer Portrait Co., 3600 Halsted St., Chicago.

WE manufacture six fascinating game boards, 100% profit. Orders repeat. Can be carried on side line where candy, pipes and cigars are sold. Particulars free. Unique Novelty Co., Independence, Mo.

WRITES with water—The Helios Pocket Pen with compressed ink; beats fountain pens ten times its cost. Sample 25c. Big proposition to agents. William Muller, Security Bldg., San Francisco.

IT'S the greatest money maker! Get next quick! "A Yard of Kids." Every woman wants one! Easiest seller. Retail, 25c. Two samples for 25c (coin or stamp). Send free! Very low price by dozen or thousand. Exclusive territory. Merch H. Sales Co., 271 W. 125th St., N. Y.

ANY agent with ordinary ability can make \$10 daily. New, attractive proposition. Write for free particulars. F. H. Montgomery, Burke, N. Y.

"SPOTOLA," removes grease spots or "Money Mark." 50c box for 3 dimes, agents wanted. Sistiola Co., Box E, Georgetown, Ill.

HOSIERY. Agents make 32% commission selling our Guaranteed Hosiery direct to consumers. Write us. Manufacturer, Box 328, Mannheim, Penna.

WANTED—Active men in every locality. To join this Society. Carry its stock, accident, death benefits. Get friends to join. Spare time. \$20 to \$150 a month. Write. Box RK-232, Covington, La.

AGENTS—Cassual sellers. Big profit papers. Novelty jewelry, perfume, hosiery. Price list, particulars free. Black Bros., 477 Eighth Avenue, New York.

AGENTS: Novelty sign cards sell easy cash. Adam Fisher Mfg. Co., 61-7, St. Louis, Mo.

AGENTS—Portraits 25c, Frames 15c, Sheet Pictures 1c, Stereoscopes 25c, Views 1c. 30 days' credits. Samples and catalog free. Consolidated Portrait Co., Dept. 119 Y, 1017 W. Adams St., Chicago.

PERFECTION Pocket Adding Machine, Lightning seller. Agents wanted. Cincinnati Specialty Mfg. Co., Dept. B, Cincinnati, Ohio.

AGENTS—\$300.00 per month, permanent business, no investment. We supply you with the best Vacuum Cleaners ever invented to sell at a price anyone can afford to pay. Settle with us weekly for machines sold. One Man to a County. Write at once. Healdman Company, 113, Cincinnati, Ohio.

OTHERS are earning \$5 to \$25 daily with our new specialty. Why not you? Send for our booklet. Wall, 224 Clark Ave., Austin, Chicago, Ill.

SALESMEN and agents, write for our money-making offer. Selling all direct to auto owners. Big profits. Easy sales. Wisconsin Mfg. Co., Marshalltown, Iowa.

AGENTS wanted everywhere for special and standard articles. Drop us a card. Particulars free. Hopkins Supply Co., Greenville, Pa.

AGENTS—\$5 daily selling our Handy Tool, 12 articles in one. Lightning seller. Sample free. Thomas Mfg. Company, 402 Tidal St., Dayton, Ohio.

TITANIC Disaster—Big \$1.50 book, retelling at \$1. Agents' prices 50c. Sample postpaid 30c. Send quick—commissioners making \$25.00 daily. Nichols & Co., Box B, Naperville, Ill.

AGENTS make 500% profit selling our gold window letters, novelty signs and changeable signs. 800 varieties in enormous demand. Catalogue free. Sullivan Co., 1238 Van Buren St., Chicago, Ill.

\$100 MONTHLY and expenses to travel—worthy men and women to travel and distribute samples. Big manufacturer, Steady work. S. Scheffer, Treas., J. W., Chicago.

IF A WEEK will start you in a big money-making mail order business—with the best line—in spare time. Particulars free. Antiseptic Mfg. Co., 1884 Barry Ave., Chicago.

STOP here! Let me start you in a home business that will bring you money every day. Experience unnecessary. Spare time. No canvassing. I furnish everything and guarantee success. Send for goods. Voorhies, Desk C. R., Omaha, Neb.

WANTED—One good man in each town to take orders for men's tailoring; beautiful styles; very low prices; orders come easy; high class; permanent business; fine profits; \$10 a day and up; no money or experience needed. We ship on approval express prepaid, and guarantee perfect fit. Write for free sample outfit and inside price on suit for yourself. Banner Tailoring Co., Dept. 517, Chicago.

AGENTS—Stop here—three wonderful sellers—patented—Postal brings particulars—Act. Novelty Co., 219 S. Dearborn St., Chicago.

SALESMAN. Sell the best \$7.50 Hand Vacuum Cleaner Made. Our Cleaner and Commissions beat them all. Address, Excelsior Mfg. Co., Logansport, Ind.

400% PROFIT selling Gordon Photo Film Top. High grade work. Samples and catalogue free. Luther Gordon Co., Northwestern Bldg., Chicago.

LADIES earn money coloring post cards; send 15c for samples and instructions. Excelsior Card Co., Roxbury, Mass.

WE manufacture four fascinating game boards; 150% profit; orders repeat; best side line with cigars, candy, etc. Particulars. Register Game Co., Independence, Iowa.

BE independent! Here's your chance. Mail order business, 22 money propositions. Brand new. Money-making. Particulars, 15c. Arme Sales System, 815 Summer Ave., Newark, N. J.

SELF threading needles. 10c a paper. Agents' samples and terms free. Ladies' Art Co., Dept. 41, St. Louis, Mo.

I WILL start you earning \$1 daily at home in spare time, storing mirrors; no capital; send for free instructive booklet, giving plans of operations. G. F. Redmond, Dept. 300, Boston, Mass.

EXCEPTIONAL Opportunity for 150c Agents—Wonderful aluminum cooking utensils, entirely new. Positively saves user's time, labor, money. Moderate in cost, without complications. Every home a prospect. Agents making big incomes. Special proposition to those who can represent us. Attractive sample easily carried. Wizard Cooking Utensil Co., Tuscola St., Saginaw, Mich.

SEE what we say under "Patents." Smith, Attorney, Washington, D. C.

AGENTS—Big money distributing free plans. Huron Soap Powder. Ward & Co., 1778 Bureau, Chicago.

AGENTS. Is "Sandling" the rage in your locality yet? Be the first to introduce it. A branch of the arts-craft. A golden opportunity for agents. Sell our outfits to housewives and boys and girls. Recorders constant. Sample outfit, 25c. John Carroll Novelty Co., Missoula, Mont.

START entirely new mail order plan. Write. B. Eldon, Farmington, N. H.

WE want to secure an agent in every town where the trade of pattern making is followed to sell the best book published on this subject. Sells for \$1.00, is a big value and ready seller. Everyone engaged in this trade or intending to learn it will want a copy. Liberal terms to agents. We protect you by appointing no one else in your community. Write for particulars. Popular Mechanics Book Dept., 318 W. Washington St., Chicago.

AGENTS—Wake up. \$20 weekly, combination key-ring, seven tools in one. Lightning seller. Sample 10c. A. Reetz, Bendley Beach, N. J.

ANCIENT and modern tricks exposed; use for stamp. "Sentenn." M 737 Ursuline St., New Orleans.

AGENTS, rapid seller, large profits. Sample 10c. Shurwin, Lock Box 422, Dept. 4, Granada, Miss.

SHIN letter agents—Painters: Something new and better: Attractive Gold or Silver Letters, 21 different kinds. Anyone can apply them. Make big money lettering store windows and selling our sparkling, flashing chipped glass nameplates and signs. 1912 catalogue and sample letter free. Attractive Sign Co., 2835 North Clark St., Chicago.

Big Money in Selling Used Automobiles.—No business so easy to learn, so profitable, so successful. On \$50 to \$100 investment our agents make \$50 to \$100 per week. We furnish the cars and teach you how to drive, sell and repair them. Write today for particulars and territory. The Automobile and Cycle Company of America, Dept. L, 1769-1787 Broadway, New York City.

MAKE big money—best opportunity. Handling agents not wanted to sell Piles. The best toilet soap paste manufactured. Indispensable household aid. We assume all risks. Write now for territory. Dapwell Brothers, Newton, Mass.

BOYS! Be your own boss and make \$25 to \$30 a week selling direct to owners of Autos, Launches and Wagons our new 1912 Electric Auto Launch Light. Sells at sight. Beside the money you make selling the goods, you are going to give away as prizes, Bicycles, Cameras, Howard Gold Watches, Encourages and Automobiles. Will you take one? Write now for full particulars. Don't stop. The W. A. Fenner Co., Providence, R. I.

KEY tag—German silver—marked with your name and address, with key ring, 15 cents. We want you to take orders. 100% profit. We sell blank tags, steel letters, key rings, etc. Deane, 210 Market, Winchester, N. H.

WANTED—Live agents to sell "The American Lady Fling Brown" on 1 year's guarantee. Does away with corn blisters. Exclusive territory; free samples; big, permanent business; 1 man in every town. F. L. Hurt, 2255 S. State St., Chicago.

Portrait agents, 16x20 wraps, saps, postcards, bromide, 40 cts., big money in our success portrait; delivery guaranteed or money back; portrait and frame catalogue and sample free. Stegfeld Portrait Co., Dept. P. M. 2, 5419 Ellis Ave., Chicago.

CUT out fads and fancies. Handle a sensible, guaranteed line of newly-patented household inventions; permanent employment. Send for catalogue and unique selling plan. Lyon-Brosed Mfg. Co., East St. Louis, Ill.

BUKALA Diamonds—Agents, everywhere. To wear and sell our famous Bukala Diamonds. Write for sample offer and catalogue. Fico Northwestern Jewelry Co., 32 Northwestern Bldg., Chicago.

LIVE agents are making big money selling our latest cigar lighter—Wing and you! Sells on sight. Sample free. Particulars free. Galt Sales Company, 5747 Long Ave., Dept. C 48, Chicago.

AGENTS—The money is yours if you grab this winner. It sells to everybody. No talking necessary. Just show it and the sale is made. 100% profit. The wise agent will send for free particulars. C. S. Rush, Dept. A 664, N. St. Clair St., Pittsburgh, Pa.

AGENTS (either sex) for "Patons," the portable washing helper. Request orders, exclusive territory. The sample for 5c postage. Thurman Mfg. Co., 1062 W. Chicago Ave., Chicago.

CONSIDER the immense field for a fan motor operating on gas or gasoline and your agency application will be sent immediately. Essex & Smith Co., 8 Lock St., Buffalo, N. Y.

AGENTS make enormous profit handling our quick-selling imported Oriental carpets and textiles. Never been advertised. No orders. Exclusive territory. Write for particulars. Shaw Rancowitz, Box 529, Portland, Oregon.

\$5.00 PER day easily made handling our specialty. Particulars free. Write us. White Specialty Company, 5459 Prairie Ave., Chicago.

AGENTS wanted in every county to sell Hazen's Stinging Powder. From \$15 to \$200 a month can be made. Send 25c for twelve shares and terms. Seelig & Wadsworth, Hingham, Pa.

EASY \$150. New specialty. Needed every home. Sells on sight. Biggest profits with Bushong's Line. Bushong, Box 157, Pendleton, R. I.

ALUMINUM Plant or Chloro Speculator. No and common bottle, sample 15c. Particulars free. Hubert, 8 Morris Crescent, Yonkers, N. Y.

LIVE agents make \$25 daily. Auto owners buy at sight. Send for particulars. Ivesdale Mfg. Co., Dept. 10, 202 Main St., Buffalo, N. Y.

MAKE money, sell our merchandise. Send 25c for Catalogue and Chain. Arthur Ross, 621 Highway, Baltimore, Md.

WANTED new agents specialty. Big seller. Send the quick for sample. Particulars free. H. H. Jorgensen, 2325 W. Diversey Ave., Chicago, Ill.

AGENTS to sell "The Story and Wreck of Titanic." Best discount and territory. Religious specialty. 3201 Cedar Ave., Cleveland, Ohio.

LIVE agents—Don't be idle, make big money; 25 excellent propositions. Hall Manufacturing Co., Miami, Fla.

AGENTS wanted—100% profit selling Safety Razors. Agents' outfit 50 cts. Jacobson Specialty Co., N. Main St., Jamestown, New York.

HELP WANTED

WANTED one thousand chauffeurs and rural men. Our demand for automobile engineers exceeds the supply. Calls for men of intelligence and mechanical bent capable of commanding \$100.00 to \$150.00 per month upon graduation. Resident course \$20.00 to \$60.00. Home Correspondence course completed by practical road and shop work at this school. Highly successful. Look this up. Auto Schools of America, Dept. T, 1600 Michigan Ave., Chicago.

AGENTS Wanted—We want a live wire agent, either engineer or specialty salesman in every town to furnish lists of names and take orders for Akron Metal Gaskets, the most complete line of metal gaskets made. Write for our proposition. Akron Metal Gasket Company, Dept. P. M., Akron, Ohio.

WANTED by U. S. Government: Mail Clerks; Carriers; Clerks in Patent Office; Agriculture; Treasury; Army; Navy; and other departments at Washington. Excellent salaries. No "layoffs." Short hours. Annual vacations. Position would be yours for life. Examinations everywhere soon. Common education sufficient. Thousands of appointments coming. "Full" university. Farmers eligible. Write immediately for sample questions and larger illustrated book telling duties and giving full particulars. Franklin Institute, Dept. C21, Rochester, N. Y.

SALESMEN Wanted. To sell the best line of Light Furniture and Piano Benches on the market, on a commission basis in Minnesota, Kentucky, Nebraska, Oklahoma, North and South Dakota, Missouri, Tennessee, Alabama, Georgia and Louisiana. Address Art Norrby Co., Chicago, Ind.

STOP here! Let me start you in a home business that will bring you money every day. Experience unnecessary. Spare time. No canvassing. I furnish everything and guarantee success. Send for goods. Your-ides. Desk C. B., Omaha, Neb.

GOVERNMENT wants post-office clerks—carriers. \$85.00 month. Examinations everywhere soon. Catalogue free. Franklin Institute, Dept. C21, Rochester, N. Y.

I WILL start you earning \$4 daily at home in spare time, silvering mirrors; no capital; need for free instruction booklet, giving plans of operation. G. F. Richmond, Dept. 306, Boston, Mass.

EARN \$10 to \$15 a week and hold your position besides. No canvassing. We, as manufacturers of patented just-in-season specialties, have now easy mail order plans to keep factories busy. We furnish everything. Large profits. Small capital. Experience unnecessary. If you are one of the want-to-go-ahead-kind, write for our most modern copyrighted plans. Seven statements. A. M. Pease Mfg. Co., 540 Pease Bldg., Michigan St., Buffalo, N. Y.

MEN and women wanted for government positions. \$50.00 month. Thousands of appointments coming. Write for free list of positions open. Franklin Institute, Dept. C21, Rochester, N. Y.

YOU are wanted for Government job. \$80.00 month. Send postal for list of positions open. Franklin Institute, Dept. C21, Rochester, N. Y.

BE an electrical workman—\$100 to \$1,500 a year. New field. Demand for competent workmen greater than supply. Personal, practical mail instruction qualifies you for splendid position. Graduates assisted. Write for particulars. Fort Wayne Correspondence Schools, Dept. 20, Fort Wayne, Ind.

BIG money waiting agents. Hundreds of dollars have been made by writers of successful words or music. Past experience unnecessary. Send us your song poems, with or without music, or wait for free particulars. Acceptance guaranteed at copyright. Washington only place to secure copyright. H. Kirkus Dupdale Co., Dept. 305, Washington, D. C.

WANTED—Men and women: for position, agent positions. \$80.00 month. Annual vacations. Short hours. No "layoffs." Common education sufficient. Over 12,000 appointments pending. Indefinite increase salary. Farmers eligible. Send postal immediately for free list of positions open. Franklin Institute, Dept. C21, Rochester, N. Y.

I MADE \$50,000 in five years with a small mail order business; began with \$5. Send for free booklet. Tell how. Hancock, 5071 Lockport, N. Y.

WANTED—Handling men in each locality. John Eric Society, 515c, prevalent. death benefits. Introduce our Memberships. Spare time to start. \$50 to \$200 a month. Write, Box 1P-238, Corvallis, Ky.

MEN and women wanted for government positions. \$80.00 month. Short hours. Annual vacations. Thousands of appointments coming. Write for free list of positions open. Franklin Institute, Dept. C21, Rochester, N. Y.

FREE illustrated book tells about over 250,000 protected positions in U. S. service. More than 40,000 vacancies every year. There is a big chance here for you, sure and generous pay, lifetime employment. Easy to get. Just ask for booklet A29. No obligation. Earl Hopkins, Washington, D. C.

WANTED, Agents, Machinists, Attention! Increase salary, new revised Saunders Hand-Book of Practical Mechanics. Best ever ready reference. Thousands in use. Postpaid \$1.00 cloth; \$1.25, \$1.50 leather flap. Big profits. R. H. Saunders, 210 Lancaster St., Boston, Mass.

PAUL Sam is a direct employer. Qualify for a Government position. We prepare you by mail for any Civil Service Examination. Write today for free Booklet 32, Capital Civil Service School, Washington, D. C.

GOVERNMENT post office examinations everywhere soon. Get prepared by former U. S. Civil Service Examiner. Write today for free booklet. Patterson Civil Service School, Box 620, Rochester, N. Y.

MAKE money writing short stories. Big pay. Free booklet tells how. United Press Syndicate, San Francisco.

REPRESENTATIVES wanted everywhere—Here's your chance. Don't let it pass. Easy money, easy work listing names and property. A line brings particulars and contract. "National Exchange," Box 72, Waterloo, Iowa.

SALESMEN—Two energetic, clean-cut men; Ohio, Georgia and Florida. The Signal Oil Company, Cleveland, Ohio.

AN intelligent person may earn \$100 monthly corresponding for newspapers. No canvassing. Send for particulars. Press Syndicate, 745, Lockport, N. Y.

MEN and boys to learn automobile repairing, driving on up-to-date cars; electricity, civil engineering, surveying. Methods most practical. Room and board while learning. Positions secured; satisfaction guaranteed; catalog free. National School of Engineering, 2119 W. 7th, Los Angeles.

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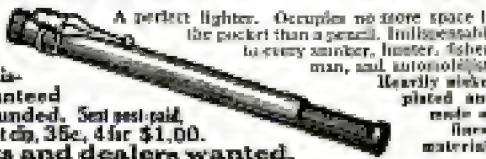
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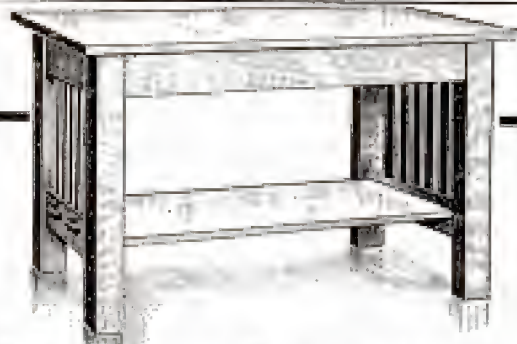
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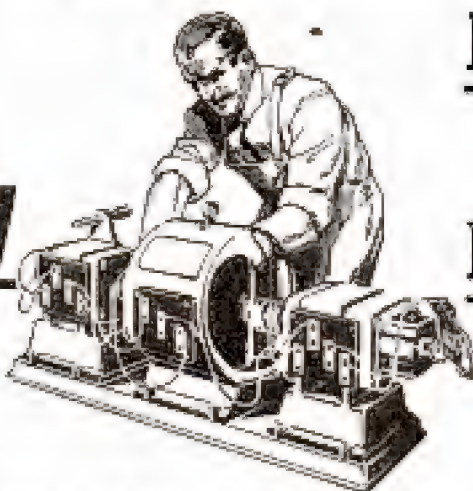
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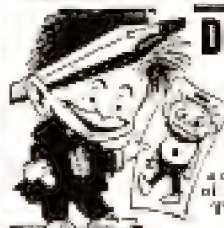
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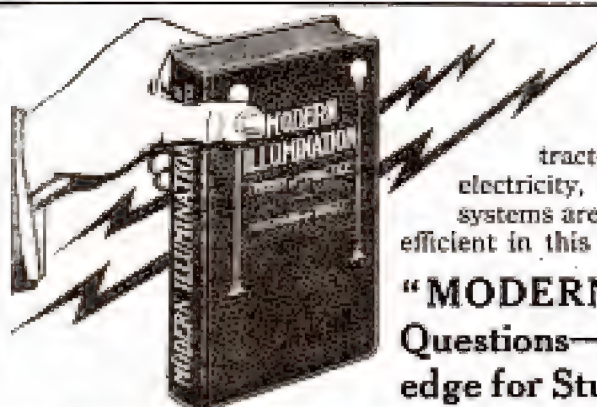
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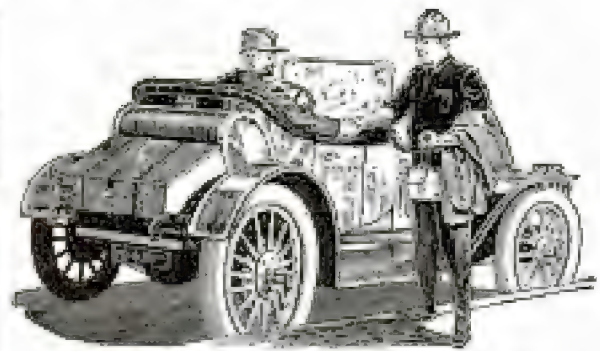
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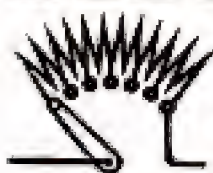
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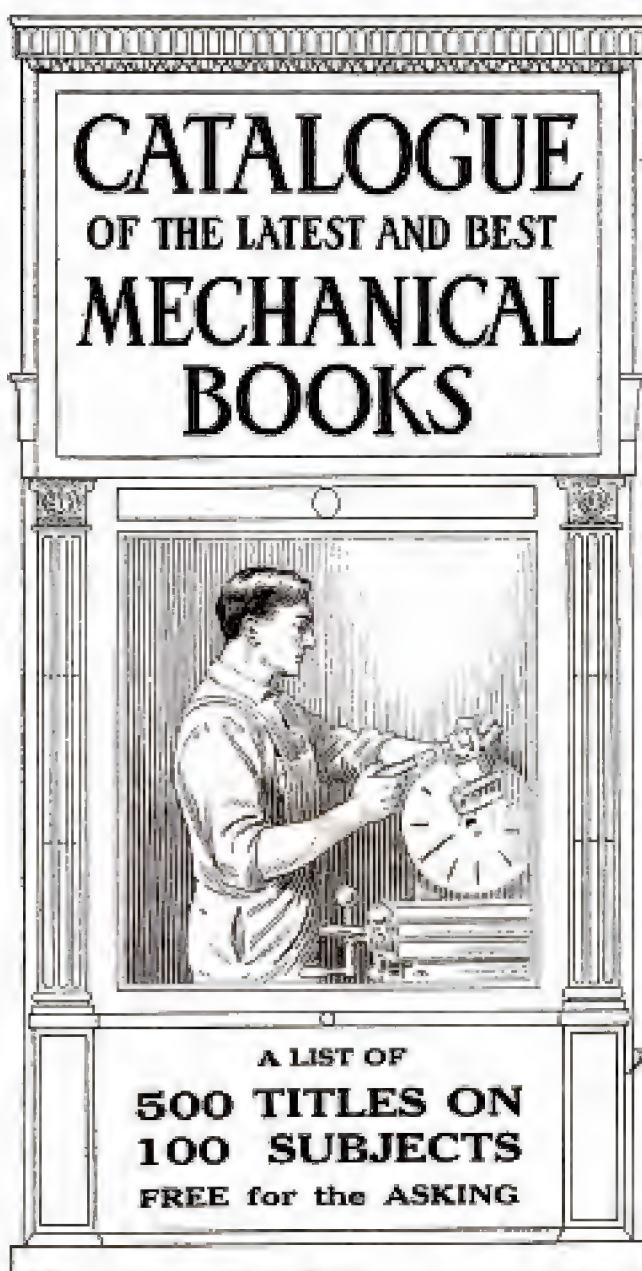
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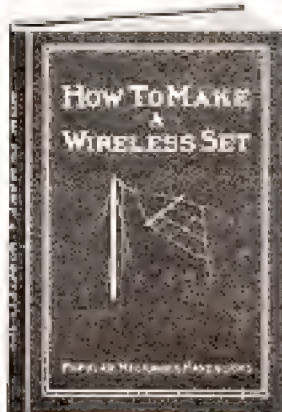
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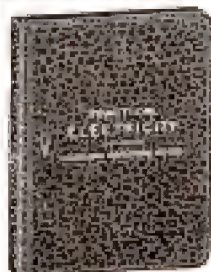
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The Importance of Training

Here is a man who was in line for a better job, but, like the great majority, had not been training himself to "fill the shoes" of the man above him; he always thought that if the time ever came he could just bluff it through—special training wasn't necessary. There's where he made *his* mistake, and there's where you will make *your* mistake if you are not a trained man. The boss had only to ask a few questions to find that the man did not know anything about the other fellow's work; that he had been wasting his time instead of improving it—that he was just one of the fellows who get into a rut and stick because he didn't have sense enough to plan for the future.

The time to plan is right now; the opportunity will come when you are ready

Don't think, as this man did, that it is simply a matter of absorbing knowledge and as a matter of course promotion will follow. Don't argue with yourself "There's no opportunity here—no incentive to do better work—I have gone as high as I can in this firm—I know as much as the boss and don't see why I can't get the money."

If the opportunity for advancement is not right ahead of you with your own firm, then it is with another. There is always an opportunity—always a chance for a better job, for better pay—yes, just the job you have often wished you had—but mere wishing will never get you anywhere; you must get the training.

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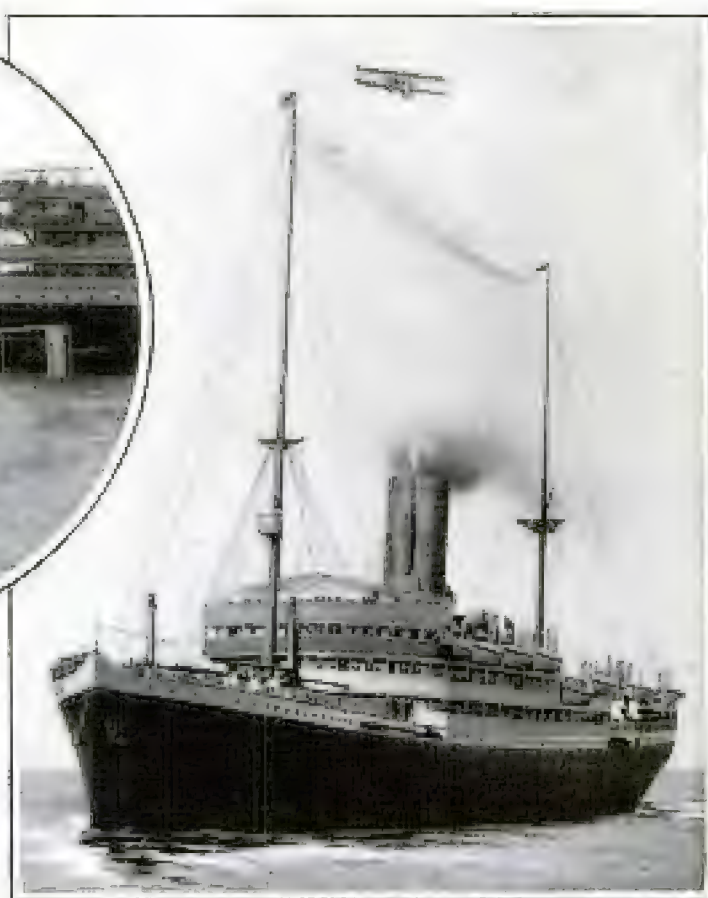
JULY, 1912

No. 1

Passenger Uses Aeroplane to Overtake Liner



Belated Steamship Passenger Leaving the Hydro-Aeroplane Which Made It Possible for Him to Catch a Ship That had Sailed a Half Hour Previously



Coffyn's Hydro-Aeroplane Hovering Over a Transatlantic Liner to Which He Brought a Passenger Who had Missed the Steamer at the Dock

Photos Copyright by International News Service

AEROPLANES have not yet been listed as part of the dock equipment of the big steamship companies—to be used to catch departing vessels by belated passengers—but there may come a time when such a means of transportation will be provided. At any rate the idea is not a wild imaginary scheme, as it has been actually tried. A belated passenger in New York recently chased and overtook a steamer sailing for Europe and was put aboard, the aeroplane being the vehicle with which he accomplished his purpose.

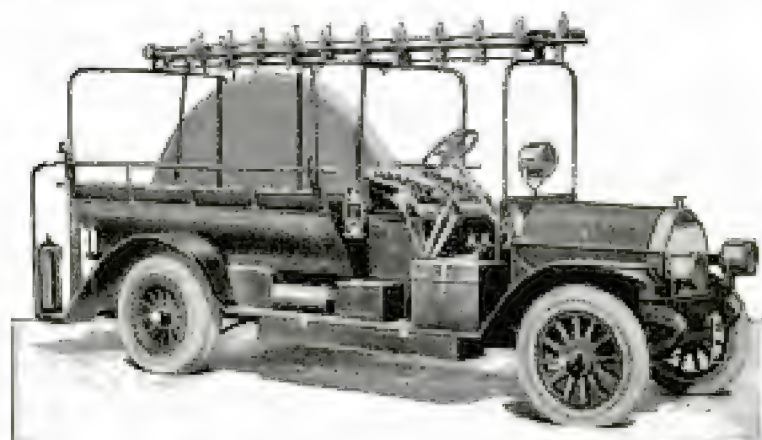
The thing was done only a short time ago. The passenger was not really belated, as he could have reached the steamer in time for the sailing if he had not made arrangements to remain a little longer ashore. Thirty minutes after the boat left its dock the passenger and Frank Coffyn, the airman, set out in pursuit in the latter's hydro-aeroplane. The flying machine caught the steamer in a very few minutes after making a record trip down New York Harbor about 500 ft. from the surface. After circling the ship twice the hydro-aeroplane

dropped to the water and a boat was put off from the steamer for the passenger. When the passenger had been taken from his machine Coffyn rose in the air again and returned to his starting point.

This is the first time this feat has ever been accomplished, although once before an aeroplane was sent in pursuit of a steamship to deliver a package to a passenger aboard.

LIFE-SAVING MOTOR FIRE TRUCK

The latest acquisition of the Springfield, Mass., fire department, which is a pioneer in the use of motor fire ap-



The Special Life-Saving Motor Truck of the Springfield, Mass., Fire Department

paratus, is a life-saving motor truck. In the center of the body, between the long side seats, is a life net, folded in so compact a form that it does not interfere with the carrying capacity of the machine. Three scaling ladders are carried on metal-rod supports above the life net. The other devices included in the equipment are a smoke helmet, an oxygen respirator for use in cases of partial suffocation, and a medical outfit.

NEW NON-CORROSIVE ALLOY

A patent has recently been given to the representative of a metal company in Philadelphia on a new white, non-corrosive, and malleable alloy of iron, nickel and copper. It is said that this alloy may be rolled into sheet, rods or bars, or drawn into wire, and may also be cast in sand,

ELECTRIC LIGHT WITHOUT HEAT

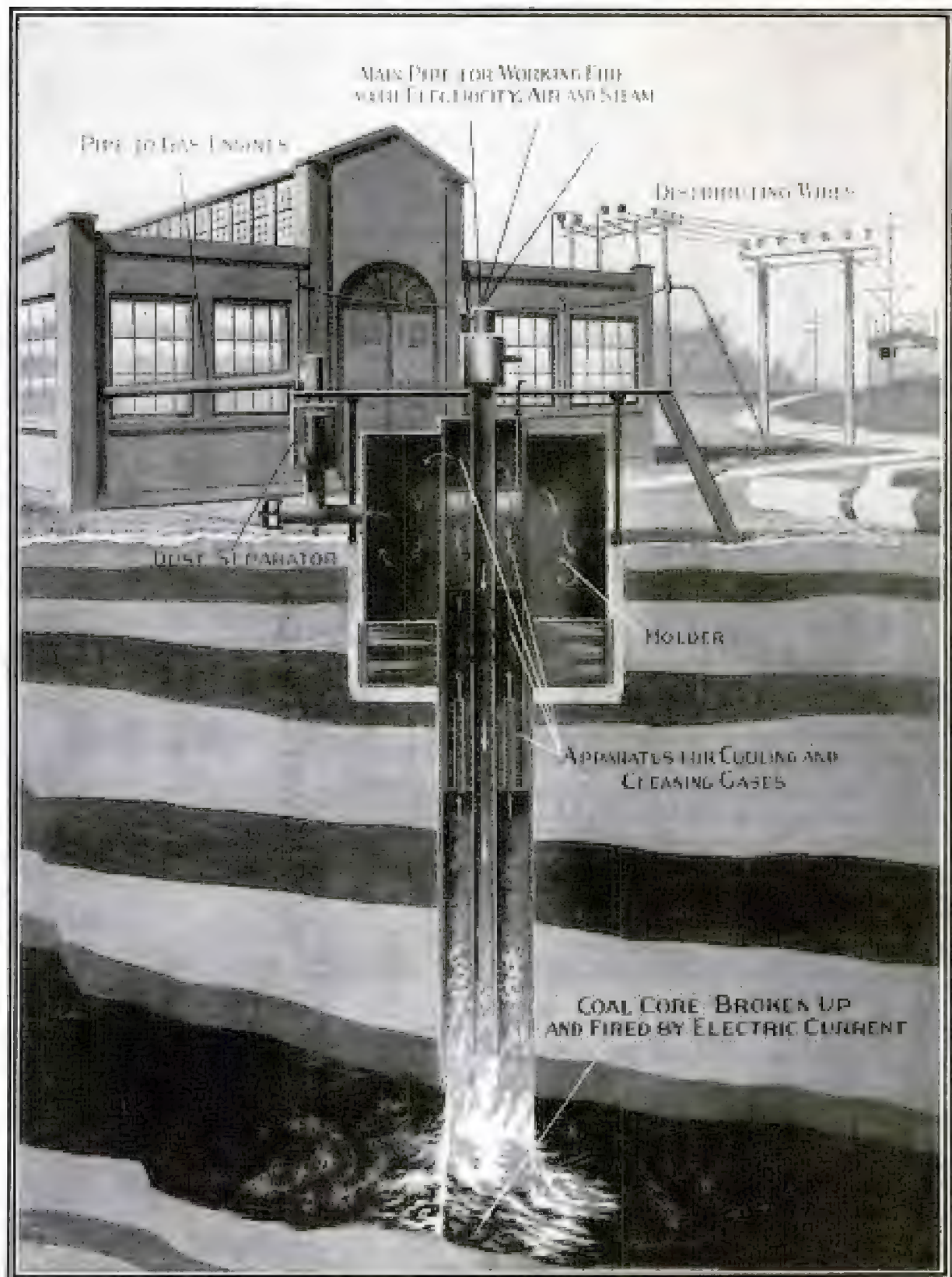
A flame that will not give off heat is claimed to have been derived by a French inventor, M. Dussaud, from electric energy. No details are given regarding this invention, however. M. Dussaud declares he has succeeded in communicating to a point of metal placed in a vacuum an electric intensity which he could not obtain with the filament of ordinary burners. This cold light can be placed without danger in close proximity to reflectors, condensers or diffusers, so that an apartment can be illuminated by an electric battery or

box of accumulators, the electricity used being 200 times less than with the ordinary light.

A tiny point of cold light, given by an electric battery of only 30 watts, sufficed to replace a moving-picture lantern, and celluloid films can thus be used without danger. Owing to the smallness of the battery necessary, there is a great future for the "cold light" for stage purposes, a boy or girl being able to carry this tiny battery anywhere. It will also prove useful for medical purposes, claims the inventor, for when the lamp is placed in the hand, the blue veins are shown distinctly against the rose-colored background. Thus it will be possible to illuminate the lungs by the use of this invention.

¶The word lens comes from the Latin word for lentil seeds which have a double convex shape like a lens.

SCHEME FOR CONVERTING UNMINED COAL INTO GAS



Sir William Ramsay, one of England's famous scientists, says there is absolutely nothing, so far as he can see, to prevent a bore-hole from being put down until the coal stratum is reached and the setting of the coal on fire by electricity, thus converting the coal in the bowels of the earth directly into gas. Air would be sent down to enable the coal to burn, the amount of air being restricted when sufficient heat had been engendered; steam would be sent down to provide a mixture of hydrogen and carbonic oxide, or water-gas; great gas engines would be mounted at the mouth of the pit or bore-hole, and the gas would be used to develop electric power for distribution throughout England.

PLAYING GOLF IN ARMOR



In the accompanying illustration is shown a well-known English baritone, who has been appearing in a London production as St. George, the patron saint of England, practicing golf strokes in his full stage suit of iron armor. On St. George's Day he played a nine-hole match on the Bushey Hall golf links, this being the first time that the Dragon-

slayer ever entered the list—or rather the links—of golf.

TESTS PROVE BACILLI NOT NECESSARY TO LIFE

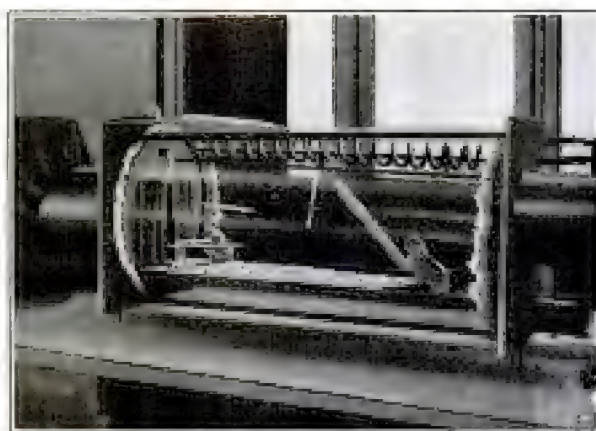
In interesting experiments at the Pasteur Institute, Dr. Cohendy has shown that bacilli are not necessary to the life of vertebrates (the division of the animal kingdom comprising animals having a backbone of bony or cartilaginous vertebrae). By using chickens for his experiments he demonstrated that it is possible for vertebrates, normally rich in bacilli, to live without these organisms.

In these experiments he sterilized the eggs the day before the chickens



Dr. Cohendy, of the Pasteur Institute, Sterilizing Eggs a Day before the Chicks were Due

were due, placed them in a bronze incubator, and put this in a hermetically sealed casing, thoroughly sterilized. After the chicks were hatched out they were able to walk about inside the glass part of the apparatus, under conditions as nearly normal as possible, but with the sand, the air, the fresh water, and the food all rendered free from bacilli. The chicks were kept sterilized for six weeks and grew as vigorously as others living under the customary conditions. They were then removed and permitted to live the usual existence, and in less than 24



The Chicks in the Bacilli-Free Apparatus in Which They Thrived for Six Weeks

hours their organs were invaded by innumerable bacilli, and no ill results were suffered.

ANTICS OF PET ANTS
AMUSE PARIS

The latest fashionable pastime in Paris is watching ants work. The insects are placed in a small quantity of earth, under a glass cover, and it is quite interesting to see them install their new home. After a time a few strange ants are introduced into the colony, and then the original dwellers mobilize to receive the invaders, closing up their subterranean passage to prevent attack, while warfare is carried on by a chosen army. This fad has become quite popular, since first brought to the notice of society by a Parisian actress, and the new game is hailed with delight.



Wreck of Seattle Dock after It had been Demolished by Steamer. Pile Driver at Right Marks End of Pier before Accident

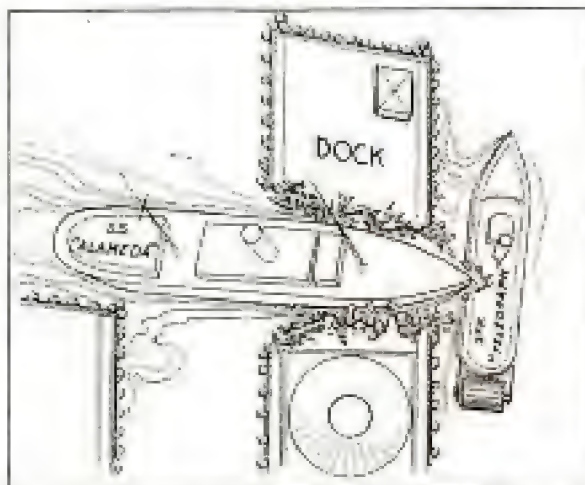
BIG SHIP CUTS THROUGH DOCK AND SINKS VESSEL

A striking illustration of the force of a steamship under way is afforded by a recent accident at Seattle, Wash., in which the steel steamship "Alameda," a vessel of 3,158 gross tons, through misinterpretation of engine-room signals, cut clean through a dock 60 ft. wide, amputating the outer end as neatly as a knife cuts cheese. Passing on through the dock the steel steamship cut an 8-ft. gash half way through the wooden stern-wheel steamboat "Telegraph," sinking her immediately.

The surprising part of the accident, from the mechanical view point, is that the steamship had barely got under headway. The "Alameda" was

light and was being warped into a slipway. The captain rang for half speed astern, and an assistant engineer threw the gear into full speed ahead. With about half her length in which to get under way, the steamship bore down upon the next dock, and despite the dropping of the starboard anchor, plowed clean through and deep into the wooden steamboat on the other side of the dock, carrying it across the slipway before headway was checked.

It appeared that the engines were not at full speed ahead for more than a couple of minutes before the error was rectified, and the signal "full astern" answered. The "Alameda" backed out of the



Sketch of the Pier When Accident Occurred, Showing How the "Telegraph" was Rammed by the "Alameda"

wreck almost uninjured, with a big wooden clock tower which had stood on the dock draped over her bows.

When one considers how difficult it was to check the headway of this steamship, 314 ft. long, it gives a

clearer idea of the difficulty of stopping a steamship the size of the wrecked "Titanic," if it were going at full speed, in time to prevent it hitting an iceberg sighted a quarter of a mile ahead.



A Complete View of the Wheeled Greenhouse, Which Covers an Area of Almost 25,000 Square Feet

A GREENHOUSE ON WHEELS

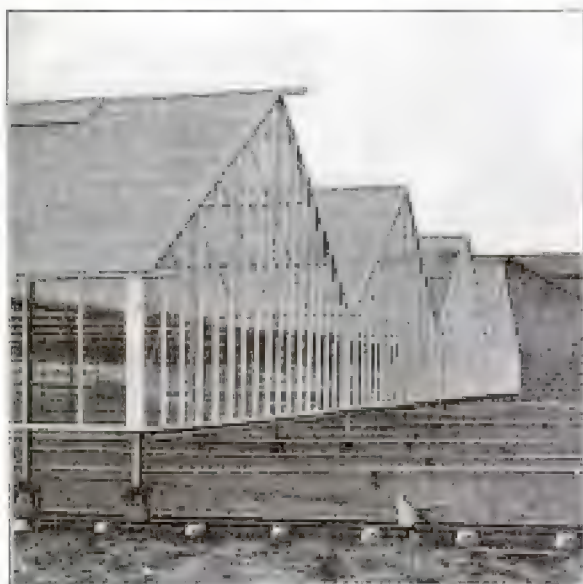
Ordinarily, carnation plants raised in the open during the summer months must be transplanted in a greenhouse for winter production, but one grower has developed a plan of transplanting his greenhouse instead of the plants. Five light tracks, placed on concrete foundations, were laid lengthwise of the carnation beds, and a greenhouse 174 ft. long by 35 ft. wide, consisting of four bays and covering a total ground space of 24,360 sq. ft., was built on wheels. Plants are set out in

the carnation beds in the spring and the traveling greenhouse is moved into position over them in the fall, thus allowing the growing process to continue without interruption.

Each bay of the wheeled greenhouse is supported by pipe posts, and the roof framework is securely trussed by means of steel T-iron and rods. All the heating pipes are carried overhead, and arrangements are made at each end for connection with the pipe lines leading from the heating plant.

HOW NAVY GUNNERS USE THE TELEPHONE

The ordinary layman who cannot hear what is being said over the telephone, if a heavy truck or a trolley car happens to be passing when he is trying to carry on a conversation over the wire, looks rather incredulous when he is told that orders to gunners in the navy and army are transmitted by telephone from the observation platform at the top of one of the ship's skeleton masts or the observer's tower in a fortification. How can the gunner hear what the spotter has to say in the terrible din of battle practice, he naturally asks. That is simple enough when explained. The telephones used are very different from those put in houses, in that they



One End of the Traveling Greenhouse, Showing the Method of Drawing It over the Carnation Beds in the Fall of the Year



The Observation Platform at the Top of the Skeleton Mast of a Modern Battleship, Showing the Telephone Receivers and Transmitter on the Man Who Sights the Target, by Means of Which He Gives the Exact Position to be Fired Upon

have diaphragms constructed to magnify sound and the receivers are held close to the ears of the man taking the sight from the observer. The lat-

ter is equipped with a specially constructed transmitter which is so hung over his shoulders that the mouth-piece is close to his lips at all times.



Photos Copyright by Enriane Meller

A Deck Gun Station on a Modern Battleship Showing Gunner Receiving Information as to the Target from the Observer on the Skeleton Mast, the Long Cable Trailing behind Him Conveying the Telephone Wires

Receivers, which are bound with flexible rubber, are clamped tightly to the ears of both the gunner and the observer and the wires running from

the former's headpiece are incased in heavily armored cables of such length that the gunner can move about, dragging the cable after him.

TALKING MONKEYS AND TEACHER

Dr. William Furness, who is acknowledged to be a trained psychologist, skilled in modern critical technique, has, after two years of work in



Dr. Furness with His Two Talking Monkeys

the experimental department of the University of Pennsylvania, succeeded in teaching two big African chimpanzees to converse with a limited number of words over and above their native and phylogenetic (racial) sounds. In other words the instinctive calls of the hordes and families, tribes and individuals, have been definitely and positively excluded, and these two chimpanzees have been successfully educated to the point where they exhibit all of the earmarks of imagery, memory, and elemental conceptions.

Further than this, Dr. Furness has imported two other Borneo monkeys of the same species, which he intends to breed to the educated monkeys, and to teach the offspring, thus seeking to discover the relative facilities of the younger and older ones in acquiring a vocabulary independent of instinctive noises and jargons.

In his work Dr. Furness has used many of the newer psychological methods, many of them discovered by Dr. John Watson of Johns Hopkins University, of definitely associating a given image or object with a corresponding simple sound, different from, yet as simple as the native instinctive calls and speeches of the monkey family. Although the two chimpanzees have no large vocabulary, they have so far been successfully taught about 20 indubitable sounds that are objectively and exclusively associated with certain things.

Thus "gob" means food, "eech" means water, "rrb" means jump or run or walk, "rrgrrr" means mirror, "ssrrrr" means box, and so on. Dr. Furness was careful to approach as close to the instinctive racial calls as possible, though never quite doing so. It is possible, according to Leonard Hirschberg, of Johns Hopkins University, for even a child to note the differences in quality, pitch and timbre of the two sounds, speech and instinct calls.

Dr. Furness, like other psychologists, says that no one can ever take the so-called monkey language of Professor Garner and others who live with the animals and interpret merely the animal means of notifying each other of fear, love, danger, food, drink, etc., as serious or scientific attempts at developing animal speech. The method must be the human pedagogical one. The animal must show curiosity toward an object, and then must always be given a strictly and exclusively associational vocal noise upon seeing or wanting the same object.

¶The United States and its dependencies produce one-tenth of the total amount of sugar manufactured in the entire world.

Practical Proofs of Streamline Theory

By VICTOR LOUGHEED

Such widespread attention was attracted among students of aviation science, by the articles in the December and January numbers of Popular Mechanics Magazine, in which there were made public for the first time the facts concerning certain phenomena of the streamline form in aeroplane designing, that it affords us much pleasure to publish herewith the visible evidence of the soundness of Mr. Lougheed's conclusions which is furnished in the accompanying photographs secured at French aviation fields. It will be remembered that the most important new discovery in the Lougheed researches was the "definite propelling effect exerted on the rear portion of a streamline form" by the compressed masses of air adjacent to the form. This effect, aptly termed by its discoverer the "reaction impulse," involves one of the fundamental principles in flight engineering, and accordingly is to be commended to the most critical consideration of all who are interested in the subject. — THE EDITOR.

TO have a merely technical and theoretical appreciation of a proved fact in engineering is one thing, and to possess the same conception in a definitely practical and visualized form, so that all of its significances are clearly apparent, is something distinctly different.

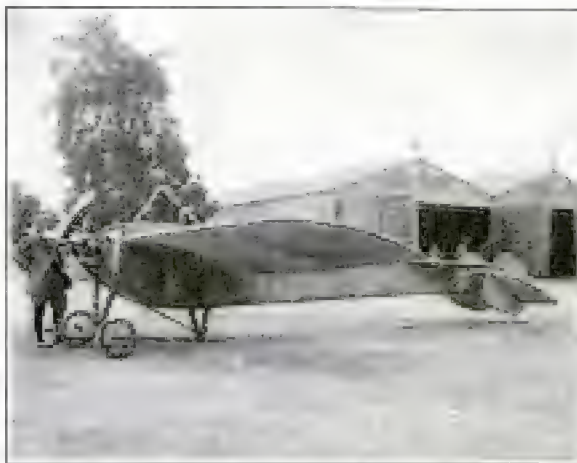


Fig. 1—Nieuport 20-hp. monoplane on the ground, showing tautness of the body fabric when the machine is at rest; thus proving, by contrast with the same machine in the air, the reality of the "reaction impulse."

To realize, for example, that objects of different forms and sections differ in the resistance they oppose to movement in the air is a simple, readily-understandable, and probably not even a very interesting proposition. But really to see in an illustration or, better

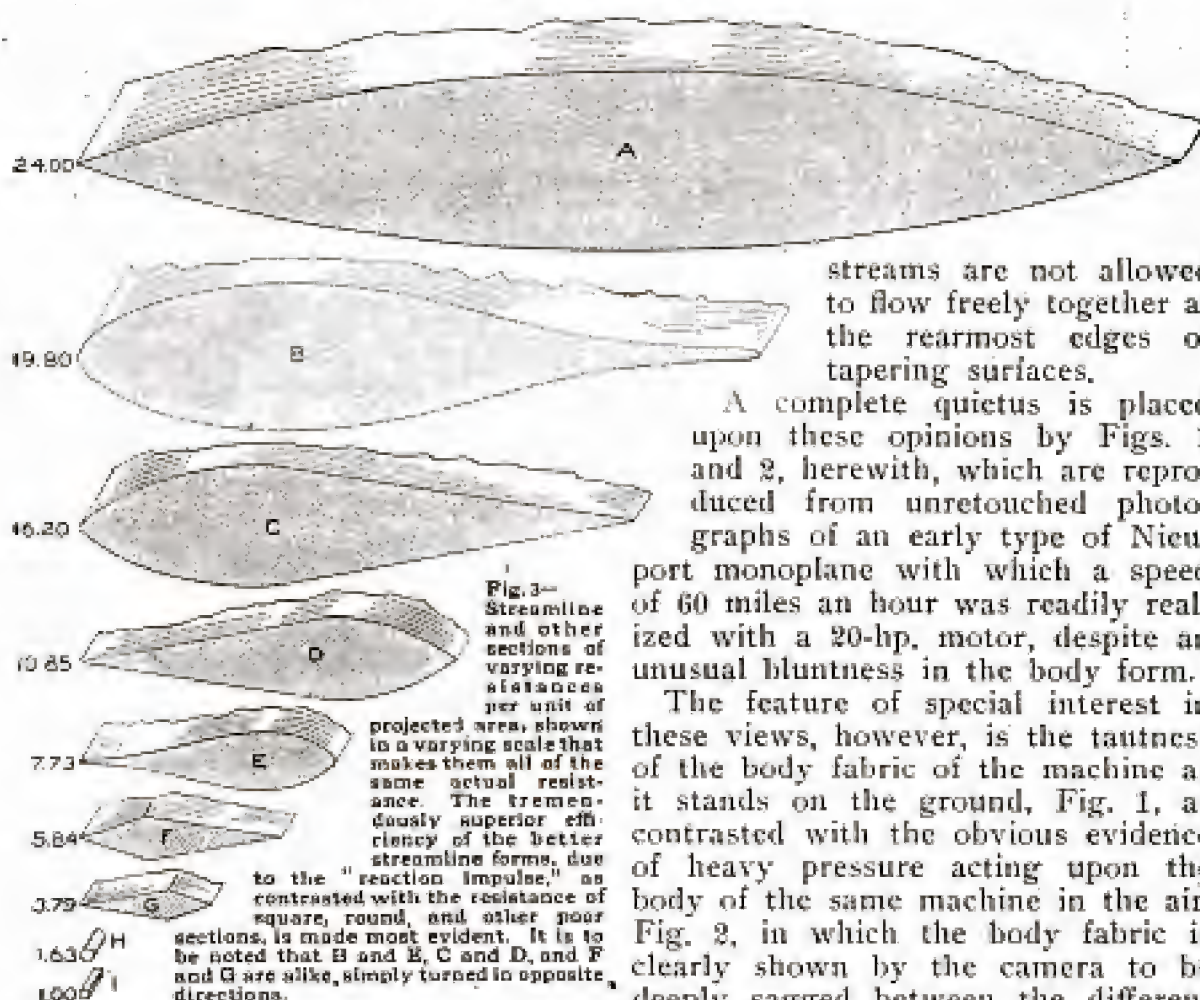


Fig. 2—The "reaction impulse" made visible on a Nieuport 20-hp. monoplane in the air, with the body fabric deeply sagged under the pressure that is the heretofore undiscovered secret of the efficiency of the streamline form.

still, in an actually operative machine, the absolute quantitative effect of these qualitative differences is to possess a type of knowledge that reaches

upon the poorer forms that have been experimented with for aeroplane elements is due to a retarding suction, supposed to manifest itself, if the air

← DIRECTION OF MOVEMENT



the average mind with an explanatory force, wholly lacking in text dissertations or tabular presentations of the same facts.

The writer recently published a claim to have discovered that the remarkable efficiency of streamline forms and sections is due to a propelling pressure, exerted on the tapered rear portions of these bodies by adjacent masses of air that are, for the moment—as a result of their initial separation by the front portion of the object—in a condition of dynamic and rapidly dissipating, but nevertheless very real and measurable pressure. In contradiction of this claim it has been asserted that the greater retarding effect of the atmosphere

streams are not allowed to flow freely together at the rearmost edges of tapering surfaces.

A complete quietus is placed upon these opinions by Figs. 1 and 2, herewith, which are reproduced from unretouched photographs of an early type of Nieuport monoplane with which a speed of 60 miles an hour was readily realized with a 20-hp. motor, despite an unusual bluntness in the body form.

The feature of special interest in these views, however, is the tautness of the body fabric of the machine as it stands on the ground, Fig. 1, as contrasted with the obvious evidence of heavy pressure acting upon the body of the same machine in the air, Fig. 2, in which the body fabric is clearly shown by the camera to be deeply sagged between the different elements of the wooden framing beneath it. Since the fabric is very stout, and is tightly stretched in applying, as is evident in the flat and uniform appearance presented when the machine is on the ground, it is certain that the dished-in appearance in the air can be due to nothing else than the dynamic pressure previously referred to, thus visibly acting on the wedge-like rear of the body.

Concerning the question of suction, as constituting a retarding influence upon the movement of any object through the air, it seems incredible that, in view of the trivial inertia and extreme mobility of masses of air, it is in any way possible to create a measurable vacuum in a free atmosphere.

Consider, for example, the condition of a piston being drawn out of a closed cylinder. In this case there is, of course, a high vacuum established,



Fig. 4—Comparison of streamline form with streamline section, both approaching the observer. Though the diameter a b , and the displacement of air c d , are of the same linear extent in both cases, the difference in the geometrical conditions involved compels the air at f f , in the case of B, to be compressed into one-half of the space it originally occupied, as against the compression into three-fourths of the original space at e e , in the case of A.

with a corresponding resistance to the movement of the piston. But if in place of the usual rigid cylinder there should be substituted some soft, flexible tube—like the thin inner tube of a very light bicycle tire, say—then, is it conceivable that any possible rapidity of piston movement could prevent the tube from caving in under the exterior atmospheric pressure behind the piston? To carry the reasoning further—when there is not even so frail and flexible a tube as that just premised, how can it be in

solite assurance that the most that can occur is for the moving object to drag with it a greater or smaller mass of air, too small in volume and too



Fig. 5—Side view of streamline body A compared with streamline section B, showing the shortening of the former to secure equivalent effects.

light in weight, in even the most extreme case, to add appreciably to the load.

Another point that is against the vacuum theory is the fact that the normal sea-level atmospheric pressure is materially over a ton to the square foot, so if the vacuum condition prevailed at all, it should be reasonably expected that the resistance due to it would be vastly higher than any that are now discoverable, for even with the most ill-designed machines that have been flown—at speeds as high as 100 miles an hour—the resisting pressure to the square foot of projected area in no case is as high as 30 lb. to the square foot—only 1/10 of atmospheric pressure.

Figure 3 is another startling exam-

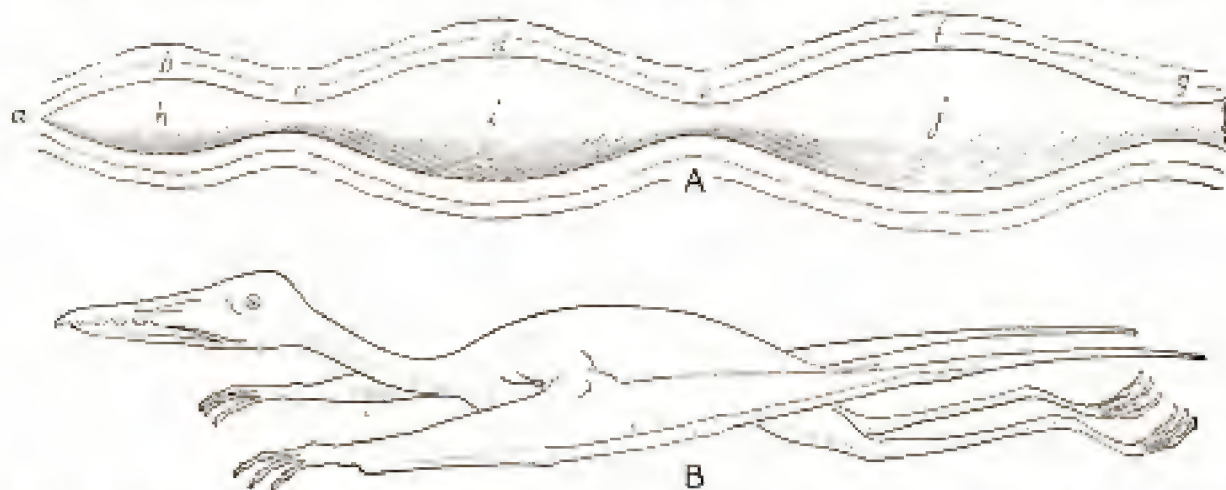


Fig. 6—At A is shown a plurality of streamline bodies, providing a succession of compressions, reactions, recompressions, etc. At B is pictured a reconstruction of the extinct pterodactyl, in which, as in many birds, the head and body constitute the first two elements of such a system of tandem streamline bodies as that sketched at A.

any way possible to produce a measurable retarding vacuum behind a moving object in the free atmosphere?

In fact, it can be stated with ab-

ple of what the "reaction impulse" really means to flight efficiency. This diagram is based directly upon researches made by Sir Hiram S. Maxim

in conjunction with his aeroplane experiments in England in 1893, and by him published—with a seemingly unaccountable failure to emphasize their full importance—on pages 53-55 of his book "Artificial and Natural Flight." Accordingly, the numerals appended to the different sections, from A to I inclusive, show the relative resistances of these different forms, without any change from Maxim's data, but the essential difference between this diagram and ones previously published consists in the reproduction of the different sections on a relative scale that is in inverse proportion to the relative resistances—

so that the various sections, with the sizes as shown, have all the same resistance. So in this presentation there is made most plain the tremendous importance of designing every part of an aeroplane, even including the struts and stay wires, in the most perfect streamline sections possible.

In Fig. 4 is shown an interesting and heretofore neglected distinction that it is necessary to make between streamline *sections* and streamline *forms*. In this diagram, A is a front view of a streamline body, or form, coming towards the observer, while B is an edge-on view of a strut of streamline section, similarly moving toward the observer. Now, assuming that the dimension *ab*—the diameter of the streamline form in the case of A and the maximum thickness of the strut in the case of B—is one inch and that the zone of air thrown

into measurable compression by the passage of the two objects extends from *c* to *d*, a distance of two inches, then a most interesting condition results. This is because in the case of A the air is displaced by the form radially, in all directions, into the annular space *cc*, which—because of the geometrical law that the areas of circles increase with the squares of their dimensions—is a space three times as great as that occupied by the form. In the case of B, however, the air is not displaced radially by the strut, but, because of this being of an indefinite length, is moved directly up and down

into the space *ff*, of an area and consequent volume only as large as that occupied by the form.

To sum up, it is now clear that the passage of the streamline form compresses the four volumes originally included in the larger circle at A into a space three-quarters as large as that they originally occupied, while in the case of B the passage of the streamline section compresses four volumes of air into a space only one-half as great as that originally occupied by them.

The inevitable conclusion, then, is that the pas-

sage of a streamline strut of a given section must, at a given speed of movement, produce a more positive dynamic pressure than can be realized by the passage of a similar streamline form, because the latter wedges a less amount of air into a larger space. And to secure equivalent compressions and

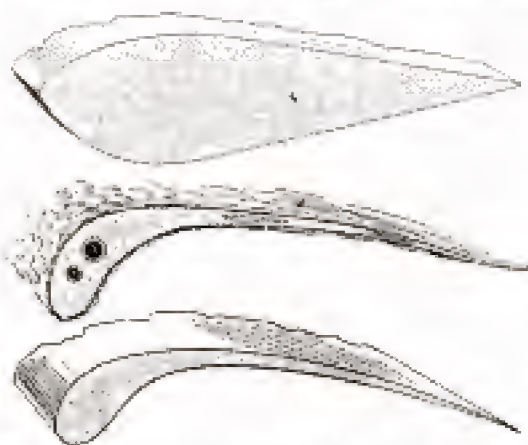


Fig. 7—Unsymmetrical streamline body and wing sections, the first being the body of a Nieuport monoplane, the second the section of a pelican's wing, and the third an aeroplane supporting surface.

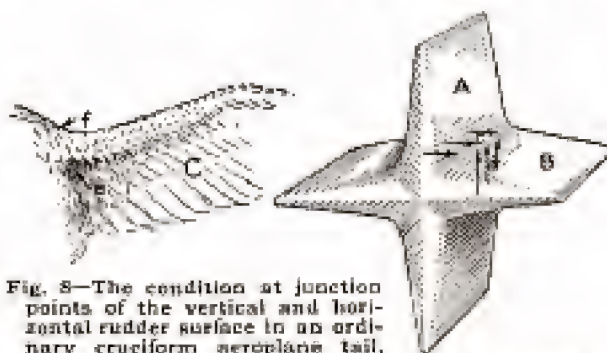


Fig. 8—The condition at junction points of the vertical and horizontal rudder surface in an ordinary cruciform aeroplane tail, showing the analogy between the filleting required as the result of the interfering movement of air, *c d*, with the abrupt enlargement at *e f* in a bird's wing.

reactions from streamline forms and streamline struts, the forms must be made materially shorter and more abrupt in their curvatures, as is suggested at A and B, Fig. 5, so that the abrupt displacement of the air in the first case will compensate for the lower compression it otherwise tends to produce.

Moreover, to have recourse again to nature for the evidence with which to support a conclusion, it is to be noted that whereas the wings of birds are of considerably elongated streamline sections, of thicknesses ranging from $1/6$ to $1/8$ of the chord dimensions, the bodies of birds are relatively much shorter, of major transverse dimensions ranging from $1/2$ to $2/3$ of their length.

Another curious bearing of the streamline principle and of the "reaction impulse" it involves is suggested at A, Fig. 6, in which the construction is intended to suggest a plurality of streamline forms ranged one behind another like beads on a string. In such a case there is first the penetration of the air by the point *a*, with the consequent compression to *b*, followed by the "reaction impulse" to *c*,—from which point there would seem reasonably to take place a recompression to *d*, with another reaction to *e*, recompression to *f*, reaction to *g*, etc. Incidentally it is to be noted that, since the "reaction impulse" never can be 100 per cent efficient, there must be a slight loss each time, so that the logical way to compensate for this loss is by the expedient of making the successive forms each somewhat larger than the one preceding.

To progress from the theory to its application, it does not require more than the most casual consideration to realize that there are many birds and flying animals in which the head and body constitute the first two elements of such a system of tandem streamline forms. This is particularly evident in

the body of the extinct pterodactyl, sketched at B, Fig. 6.

Other examples of adaptation of the streamline principle to special cases are suggested in Fig. 7, in which there is shown first the body of a Nieuport monoplane and below it the sections of a pelican's and of an aeroplane wing. The first of these is an unsymmetrical streamline form, and the others are unsymmetrical streamline sections. The reason for the first would appear to be in some way related to the fact that when an aeroplane is in flight the air adjacent to the top surfaces is in a condition of lower compression than that underneath, which is loaded with the weight of the machine. Consequently it is not likely that a given reaction effect would be secured with the same curves and contours above as below, wherefore the unsymmetrical construction, which in

this machine is an adaptation of the bird body form, seems completely justified.

In the case of the wing sections, it is here a necessary condition of operation that the air below the

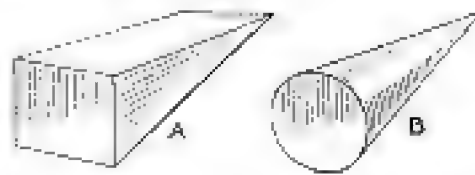


Fig. 3—At A is shown a streamline body tapering like a wedge, while at B is shown a cone-like body tapering to a point

wing should be compressed as intensely as possible, while that above is compressed very little—preferably not at all. In consideration of these points, it will be now realized that a wing section is virtually a streamline section bent into an unsymmetrical curve to produce an unsymmetrical effect.

Figure 8 is a sketch intended to illustrate the conditions that apply in the angles where vertical and horizontal rear-rudder surfaces of the common cruciform types come together. In this, the fact that the air moved by the surface A in the direction *c* must inevitably impinge against that moved by B in the direction *d*, results in an interaction increasing the compression above normal in the corners where the surfaces join together. This presumably can best be allowed for in an aeroplane structure by a modification of the filleting at the junction point,

much as is suggested by the similar modification in the wing-section curves at *ef* in the bird wing C.

Another point that aeroplane designers must take into consideration is the fact that a streamline form may terminate in either a wedge as at A or in a point as at B, Fig. 9. While the tapering to a point is probably the ideal, the tapering to a wedge has certain practical advantages, not the least of which is found in the superior security it allows for the means of rudder attachment. And what is lost in the "reaction impulse" sidewise probably is largely regained by the greater area exposed to the "reaction impulse" above and below.

An evidence, accessible to most observers, and which proves not merely the existence, but also suggests the quantitative value of the "reaction impulse," is found in the way in which birds when not in flight are affected by wind. It may plausibly be argued, and has been so argued, that the resistances of the bird to movement in flight are high, and are simply fought against by an amount of energy expended, which is presumed to be very great for the size of the animal. But, in winds so strong that they will compel a man to lean heavily into them to keep from being blown over, it is a fact that small birds on the streets, or larger birds perched on exposed places, while they invariably will take care to hop and move about so as always to face the wind, will rarely be observed to lean into the wind, or to be blown off their feet or out of their position by the impact of even the most violent gusts. The explanation of this phenomenon of the bird form, under a condition that bears no direct relationship to flight conditions, can exist in nothing but the "reaction impulse," of an efficiency so high as to nullify the "head resistance" almost completely.

In conclusion, to refer again to the particular example of the 20-hp. Nieuport monoplane, with its heretofore almost mystifying efficiency, it is calculated that the total projected area of the body is just about 10 sq. ft.

Against this, by accepted tables of wind pressures, the resistance at 60 miles an hour is about 170 lb. With an area in the rear portions of the body totaling about 100 sq. ft., at an average slant of about one in eight, a simple arithmetical application of the parallelogram of forces gives a pressure of about $13\frac{1}{2}$ lb. to the square foot, on the rear body surface, as the amount necessary to nullify completely the head resistance.

As a matter of fact there can be no such thing as a 100 per cent efficient nullification of the head resistance, so the actual pressure on the rear body of the small Nieuport must be less than the figure stated—probably no more than 10 lb. to the square foot, which would correspond in this case to a recovery of about 75 per cent of the energy involved in overcoming the head resistance.

A point of especial interest in connection with the subject under discussion is found in the fact that a certain degree of bluntness in a body form—instead of being as detrimental as might be supposed, in comparison with the more spindling shapes that are widely preferred—is of positive aerodynamic advantage. This is because it affords a sufficient abruptness of angle to realize efficiently the reaction impulse, which with a flatter wedge acts less effectively to force out the body from between the opposed pressures, just as it is found with slanted solid surfaces pressing together that there are angles so flat—below the "friction angle"—that lateral movement cannot occur.

In the cases of the best fliers among the birds, instead of an efficiency of only 75 per cent in the reaction impulse, the accuracy of the form, its perfect adjustment to the speed, and the exceedingly small magnitude of the skin friction—of the air flowing over the feathers—all combine to produce an efficiency of probably as high as 99.8 per cent or 99.9 per cent, if recent careful investigations are any criteria.

From all of which it must simply

and conclusively appear that the right road to efficiency in flying must lie, not in the direction of the ill-advised and too-common flimsy structures that by their small edge and projected areas *reduce* head resistance, but, on the contrary, is to be found in the use of

thick and substantial sections—like those of the bird wing and bird body—in which there is the altogether more essential provision of a type of form that efficiently *recovers* most of the energy expended in overcoming head resistance.

AERONAUTICAL ENGINEERS WANT A NAME

Some of the men who are attempting to solve the mysteries of the air are much exercised over finding a title by which their particular calling shall be known. There are all sorts of technical names for other kinds of engineers, but none has yet been developed for the man who deals with aeronautics.

There have been numerous discussions of the subject and the choice now appears to lie between "aeronautician" and "aeronician." "Aerotecnician" has also been suggested, and meets with favor when applied to the purely technical man. "Airman" still seems to be more popular for the man who actually runs a machine than "aviator," the first term employed. "Flight engineer" has the merit of being plain English, though it is scarcely as brief as might be desirable.

FISH TINTED TO SUIT BUYER'S FANCY

A large trade in goldfish is now being carried on in Sicily, the coloring being obtained by keeping silverfish in water containing certain chemicals, in the form of peat, chalk and iron. After a couple of weeks in this "mixture" the fish are transferred to another bath composed of iron and tan, which has the effect of coloring them red, or black and red, or black, red and silver—according to the length of time they are left in the solutions. These fish fetch a better price than the ordinary silverfish, found in large quantities in that region, but it is remarked that so far they die young.

NON-SPILLABLE FLOWER VASE FOR THE WAIST

An ingenious little flower vase, designed to be worn at the waist, has been invented by a flower-loving

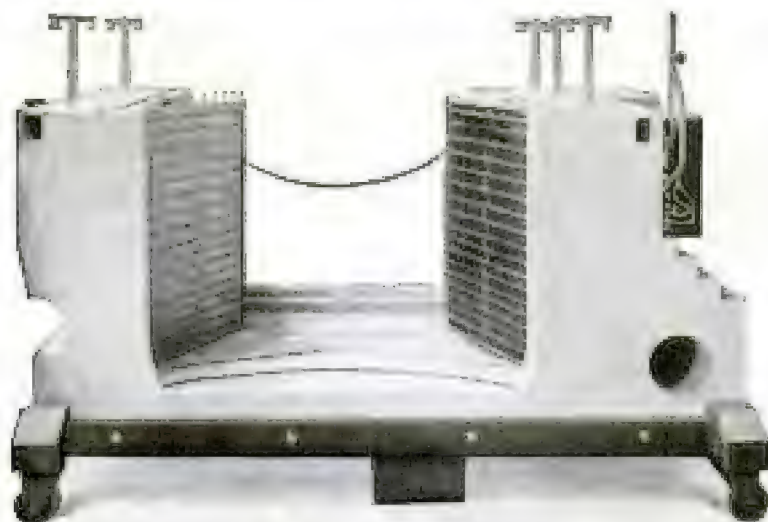


Holder for Corsage Bouquet That Keeps
Flowers Fresh

Frenchwoman. Its purpose is to provide water for flowers during the time they are worn, and it is so constructed that the water will not spill, even though the wearer should bend as much as 90 deg. from an upright position. The open end of the vase has a construction similar to that of a non-spillable ink well, and the recessed central portion of the vase also aids to prevent any outflow of water.

WORKING MODEL OF PANAMA LOCKS

Complete working models of the Panama Canal were recently set up in the Commercial Museum, Philadel-



A Working Model of the Panama Canal Locks Which Shows the Operation of the Big Gates

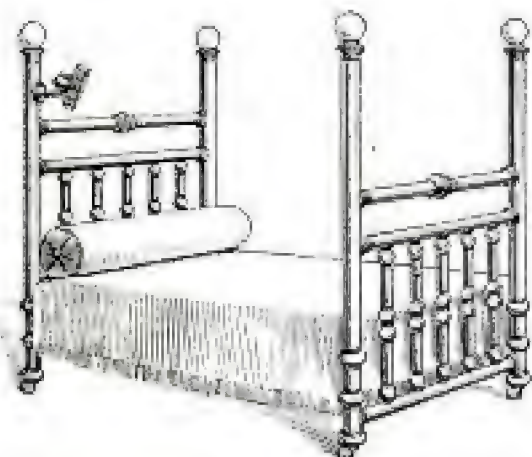
phia. The purpose of the model here illustrated is to show the way the big lock gates are worked. This model is on a scale of half an inch to the foot and is complete to the smallest detail. It is worked exactly as the big gates will be worked in the canal locks, which will be opened and closed by electricity. The miniature electrical machinery within the walls of the model can be seen in action.

CANNON DESIGNED FOR USE ON AEROPLANES

A gun that weighs 150 lb. and is so delicately adjusted that it will not show an appreciable vibration though mounted on the most delicate steel springs, has been invented by Commander Cleland Davis of the U. S. Navy for use on aeroplanes. The new gun is 12 ft. long, is made of steel, and fires a 33-lb. projectile that has a muzzle velocity of more than 1,000 ft. per second. This is the largest gun that has ever been made for use on an aeroplane and seems to give to the airman another advantage over his foe on the ground. Heretofore it has been impossible to use a gun in the air, except the ordinary rifle, for the reason that the recoil would be so powerful as to cause the capsizing of the machine, whenever it should be discharged. Commander Davis has devoted considerable time to the development of artillery. In a test that was made the gun was mounted on delicate steel springs and when discharged had no recoil that could be measured by special instruments.

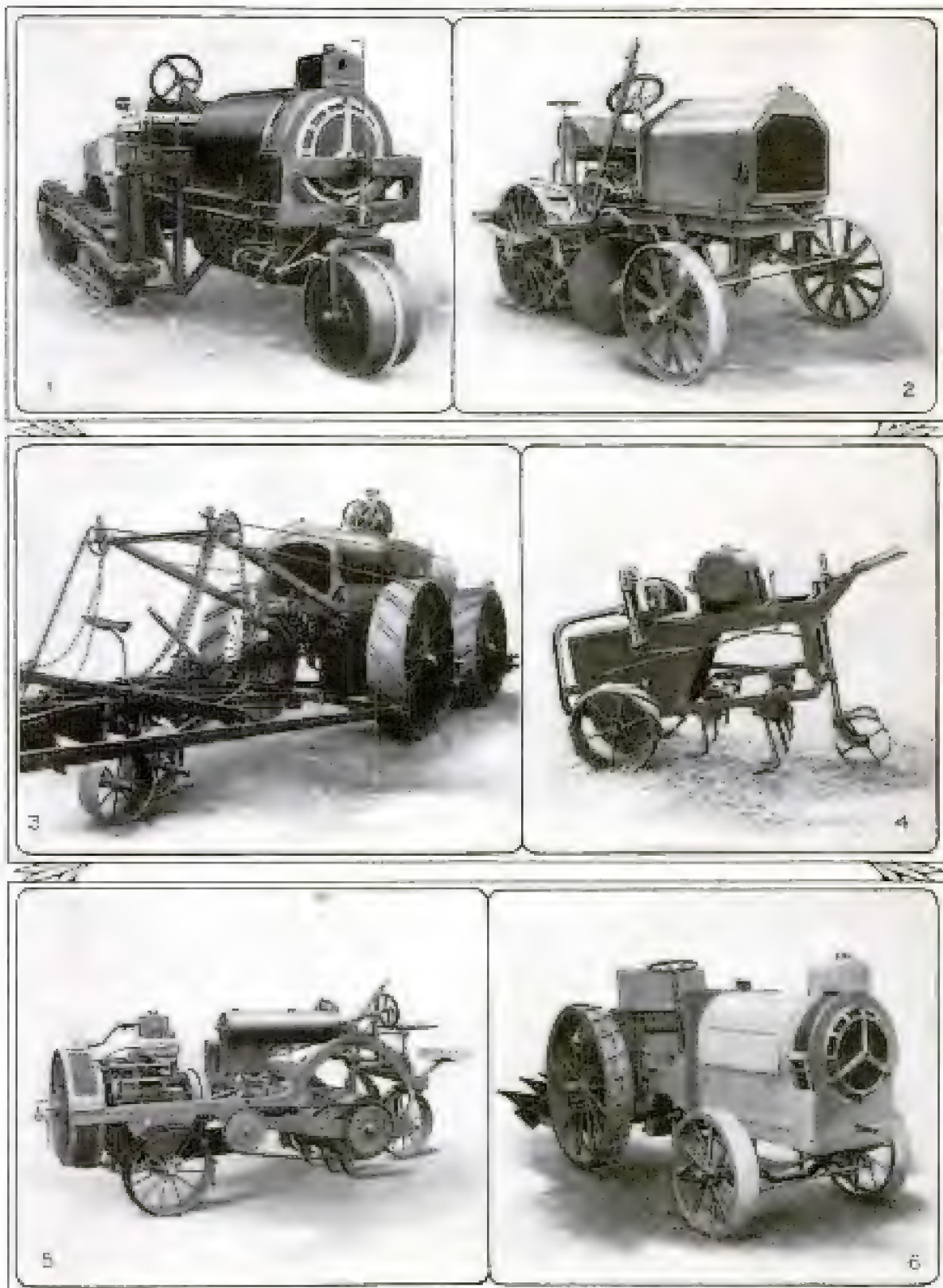
BED EQUIPPED WITH ELECTRICITY

A brass bed, especially equipped with electricity, has been built by a Cleveland manufacturing company. The tops of all four posts carry an electric-light bulb, an electric fan is mounted on one of the posts, an electric heating pad is plugged into a special outlet, and other outlets are arranged for the connecting up of devices such as a water heater and toaster. Switches for control of the devices are arranged on one of the bedposts.



Bed Equipped with Electric Bulbs on Each Post, an Electric Fan, and a Heating Pad

SOME FARM IMPLEMENTS OF FRENCH DESIGN



1—A Farm Tractor of the Caterpillar Type. 2—Plow with Single Row of Blades. 3—A 30-Hp. Machine Which will Plow About 30 Acres a Day. 4—A Harrow or Cultivator of Exceptionally Efficient Type. 5—Revolving Harrow That Breaks Up a Strip of Ground 3 Ft. in Width and is Operated with a Gnome Motor. 6—Deep-Cutting Motor Plow for Subsoil Work, but Which can Also be Used for Other Purposes

For many years the United States has been the unquestioned leader in the manufacture of farm implements, but France has entered into competition on motor farm implements, and some of the machines produced by the French manufacturers are shown above.

ARMOR FOR MOTOR TRUCK DUAL TIRES

An automobile accessories concern in Cleveland is manufacturing an armor which is designed to take the



wear off solid tires and at the same time provide a good traction surface on the tread. Arranged for dual tires, the armor consists of a series of steel plates with an indentation in the middle which

fits the space between the two treads. The plates are held in place by a band which passes around the circumference of the wheel, resting in the depression between the treads.

THE FLORAL-LOOP NOVELTY

An interesting jewelry novelty for evening wear is shown in the accompanying illustration in the form of a



The Floral Loop is an interesting Novelty in Jewelry

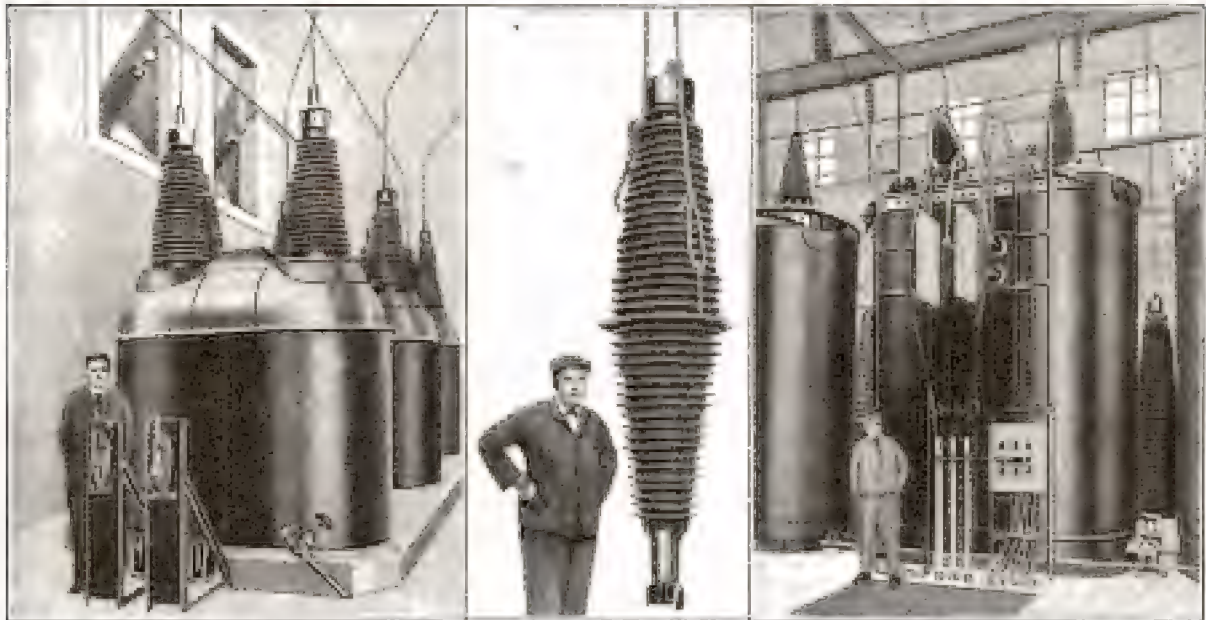
floral jewelry loop arrangement. A neat gold chain is looped from a ring on the little finger to an arm bracelet, and a little bouquet is clipped to the center of the chain.

ODD BEHAVIOR OF METALLIC- FILAMENT LAMPS

No doubt everyone who has had occasion to turn on metallic-filament lamps, has observed that the luminosity of the filament, at first, seems stronger than later on. The explanation which first suggests itself as a solution of this phenomenon is that the filament has a much less resistance at low than at high temperatures, so that, at first, more current would flow through the filament and cause a higher degree of incandescence. If this explanation be accepted, it would follow that the temperature of the filament adjusts itself more rapidly than the resistance, or, in other words, that there is a lag in the change of the resistance behind that of the temperature. This does not seem probable, however, and therefore attempts have been made to explain the phenomenon in some other way.

It was suggested, at first, that the pupil of the eye failed to adjust itself properly. The pupil of the eye contracts when the light is turned on, and more light is received at first before the pupil has had time to respond than a moment later. Experiments made with photographic apparatus showed, however, that this could not be the correct explanation.

Another explanation, which seems to be more satisfactory, is that the true cause lies in the connections that are fused in the lamp bulb. It is suggested that the temperature of these leads rises more slowly than that of the filament, and for a very short time, at the instant of lighting the lamp, tends to decrease the total resistance, and thus cause an increased current. Still another suggested explanation is that the residual gas in the globe is the cause. The vacuum in the lamp is somewhat higher when the lamp is cold because the glass walls of the lamp absorb some of the gas. With an increase in heat, the gas expands and diffuses toward the center of the globe thus increasing the loss of heat by conduction.



The 140,000-Volt Oil Switches

Terminal Bushing and Contact

One of the Huge Transformers

WORLD'S HIGHEST-VOLTAGE TRANSMISSION LINE

The 140,000-volt transmission line that was recently put into operation in the state of Michigan marks another step forward in the utilization of high voltage for the transmission of electric energy. In transmitting at 140,000 volts, the builders have effected a saving in copper of almost 50 per cent, as compared with the quantities used in the highest-voltage lines previously constructed.

The transformers, oil switches, and lightning arresters used in connection with this line had to be specially designed to withstand the exceedingly high electrical pressure to which they would be subjected.

The generators, which are driven by water turbines, deliver their output to

the transformers at 2,500 volts. The transformers, which are oil-insulated and water-cooled, raise the voltage from 2,500 volts to 140,000 volts, and deliver the electrical energy to the line through massive oil switches. The transformers are 19 ft. 6 in. from the floor level to the top of the high-tension terminals, and each weighs approximately 43 tons.

The transmission conductors, which are made up of seven No. 8 gauge wires, drawn according to special specifications, are supported on tripod steel towers, spaced about 500 ft. apart. The heights of the towers vary, depending upon the contour of the country; in one case the earth had to be excavated to clear the



Map Showing the Michigan Cities and Towns Fed by the 140,000-Volt Line

wires, while 167-ft. towers support a 600-ft. span across a river. In hanging the conductors, each conductor being held to its crossarm by a string of ten 10-in. disk insulators, a dynamometer was used, and a pull of about 1,200 lb. made on each, which allowed approximately a 12-ft. sag in each span.

It is interesting to note that there is a rise in electrical pressure along

this transmission line, which is due to a property of the line called its condensive reactance, and amounts in this case to about 30,000 volts. It must be understood that the above is not a characteristic of this line alone, but of all high-tension transmission lines, nor does this rise in voltage represent a gain in energy. The effect of condensive reactance in this case exceeds that of any other line on record.

IMPROVED MOTION-PICTURE SOUND MAKER

The assembling together in one apparatus of the many mechanisms required to produce realistic imita-



An Ingenious Sound-Making Machine for Motion-Picture Theaters

tions of all the sounds used in giving "life" to motion pictures has been ingeniously accomplished in the machine here shown. The sounds it can reproduce include the cries of a baby, the screech of projectiles fired from cannon, the warbling of a bird, the ring of the anvil, the rustling of leaves, the crashing of falling masses of metal or

wood, the engine noises of automobiles and motorcycles, the patter of rain, the rumbling of trains, the sound of waves, wind, hail, the puff of a railway locomotive, the breaking of crockery, the tolling of bells, the clang of fire bells, the clatter of horses' hoofs, the bark of a dog, the hissing and spitting of cats, the tinkle of sleigh bells, the "honk" of automobile horns, quick-firing guns in action, the clash of dueling swords, and the rattle of fetters.

The claim is made that despite its many functions it is very simple to handle.

WAR AEROPLANES AS "DOVES OF PEACE"

Unusual and remarkable as it may seem, the Italian war aeroplanes that have been almost constantly flying over the enemy's camps in Tripoli have recently been varying the diet of bombs by dropping pamphlets printed in Arabic. These pamphlets, addressed to the Turkish soldiers and their Arab allies, and to the inhabitants of Tripoli, Bengazi, Derna, Tobruk, and Fezzan, deal with the state of the war, telling of Italian victories and advising the laying down of arms.

A Berlin nerve specialist has reached the conclusion that knitting in bed is an excellent antidote for tired nerves, and has secured most satisfactory results by prescribing a course of knitting for worn-out society women of the German capital.

HOW A CAT TURNS OVER

A Man Falling from a Balloon Could Do the Same Thing,
and Our Latitude Could Be Changed by the Same Method

By FOREST RAY MOULTON,

University of Chicago

IT IS a common saying that if a cat is dropped in any way whatever, it will always alight on its feet. Since a man cannot lift himself by his boot-straps, or a boat cannot propel itself through the water except by pressing against the water in some way, one may well wonder whether this is not one of the common sayings which is fallacious. The general principles involved are of such interest that the question was taken up a few years ago for consideration at a session of a French scientific society.

It is a fact that it is dynamically possible for a cat to turn over no matter how dropped, and experiments have shown that they actually do it. If a balloonist, or airman, should fall from a great height and should find that he were descending so as to strike on his head, he could turn himself over so as to strike upon his feet, if he knew the proper means of accomplishing it. But the distance he would have to fall in order to have time to turn over would be so great that he could have only an academic interest in striking on his feet rather than on his head, for the final result to him would be the same in either case.

In order to make the principles which are involved perfectly clear, suppose A B C D (Fig. 1) is a portion of a wheel supported at O, and that it is mounted so that



it can be turned around O as an axis without any friction. Suppose A B C D is in a horizontal plane, and that on it two mice live and have their nest. Suppose they find that their nest is exposed to the north wind and that they wish to turn the portion of the wheel on which it rests around so that it will be protected from the wintry blasts and will be open to the sun's rays from the south. Suppose these mice are familiar with the principles of mechanics (having read *Popular Mechanics* every month) and that they undertake to turn their home around. Suppose they weigh but an ounce and that the weight of that portion of the wheel on which they live is 10 lb., or 160 oz.

Now the mice being wise will start at O and one will walk toward A and the other toward C so as to keep a balance. Their traveling along a radius of the wheel will have no effect upon it and will not turn it. After arriving at A and C they will walk toward B and D respectively. The way the mouse gets forward is by pushing back on the surface on which he is walking, just as a skater, in order to get forward on the ice, pushes back with the sharp edge of one skate as he makes the stroke with the other. This is a universal principle and is illustrated by a locomotive pulling a train. If the track is

slippery so that the drivewheels cannot push back upon it, the train cannot start. In order to secure the necessary friction, the engineer puts sand on the track.

When the mice were walking from O to A and C they were pushing back in opposite directions. But when they walk from A and C toward B and D respectively, they both push on the wheel in the same direction. Since the wheel can move without friction, it will move back a little in this direction. The amount it moves depends upon the force with which the mice push back. Since the wheel weighs 160 times as much as the mice, it will be pushed back $1/160$ as far as they go forward. (This is really under the assumption that the weight is all on the rim.) When they get to B and D the wheel has been pushed back $1/160$ of the distance AB.

It is very important for the understanding of the subject to notice one or two things. The momentum of the mice forward is always exactly equal to the momentum (technically moment of momentum) of the wheel backward. When they arrive at B and D they must stop before they can go toward O. In order to stop they must have some friction with the wheel, and in stopping they push on the wheel in the opposite direction to that which they pushed while they were walking. In stopping themselves they will push on the wheel exactly enough to stop it. Hence they start at A and C with the wheel at rest, and they end at B and D with it at rest. It has had no motion except in the direction opposite to that in which they traveled, and therefore it has rotated backward somewhat. The center of gravity of the two por-

tions of the rim and the mice has not changed; and since the mice have gone forward from A to B and from C to D the center of gravity of the parts AB and CD have moved back correspondingly. The wheel moved only when the mice moved, and stopped when they stopped. If the wheel were originally spinning round and round, the walking of the mice would change its position, but not its motion, after they stopped, precisely as is done when it is initially at rest.

After the mice arrive at B and D and stop, they go back to O. Then they go to A and C and repeat the whole process. By doing this a few score times, they can turn the wheel around

180 degrees and secure the results they desire.

Now suppose a man were standing over the point O. Under the same conditions as to the absence of friction, he could turn himself around by moving his arms. He would extend his hands to A and C and then swing them around to B and D. By doing

this, he would turn himself and the wheel on which he stood a little in the opposite direction. He would then pull in his arms to his body and put them out again in the direction AC, which would not turn the wheel. Repeating the process, he could turn the wheel as much as he wished.

Now suppose a man were falling from a great height. He would be perfectly free to turn in any direction, except for the slight resistance of the air to rotation, which can be neglected. If he were falling without turning over, he could work his arms so as to turn himself in any direction he desired, and the method which he would use is clear from the principles which have been explained. It has

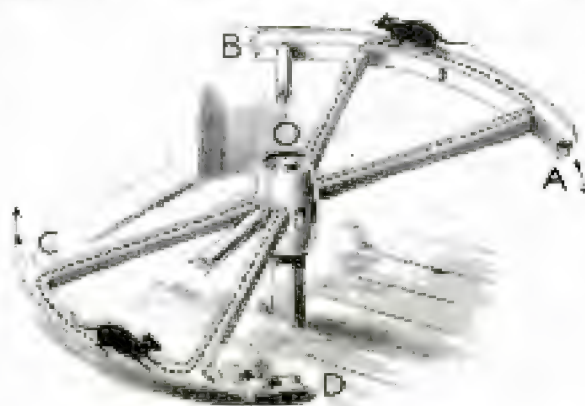


Fig. 1—Two Mice would be Able to Slowly Push a Broken Wheel Around by Running in Opposite Directions along the Rim Sections and Thus Change the Location of Their Nest

been found by careful observations of cats that they use their legs and head precisely in this manner to turn over when they are dropped. It is not, of course, to be supposed that the cats have any understanding of the mechanics of the problem; but that, by an instinct acquired by the cat family during thousands of generations, they naturally do what secures the results.

Everyone knows that our climate depends to a large extent upon our distance from the north pole. A glance at a map of North America shows that a large part of it is north of Chicago where sometimes for days and weeks the wintry blasts sift the snow through the streets. As the vast regions of Canada become more densely populated the rigors of its winters will be more and more deplored. The question arises whether it is not possible to tip the earth over so that the latitude of Canada will be less. This would bring Siberia and China nearer the pole, and the wind-swept and barren wastes of Northern Asia would become even more desolate than they are at present. Tipping the earth over is, of course, a bold proposition; but science has had so many and so remarkable triumphs in the last hundred years that no problem seems too big for it to undertake. It is not altogether a wild dream that man will sometime control the great forces of nature, and even direct the cosmic processes.

A small change in the latitude of North America might have a great influence on its climate by changing the atmospheric and ocean currents. Suppose it is proposed to change its latitude one degree. For simplicity, suppose the earth is not rotating and that

it is possible to run a train around it from pole to pole along a meridian (Fig. 3). Suppose the track runs from the south pole to the north pole through North America and back to the south pole through Asia on the opposite side of the earth. If the train should pass northward on the American side, its wheels, pushing backward, would push this side of the earth away from the north pole; and, going southward on the Asiatic side, would shove that part of the earth toward the north pole. If the train should go round and round the earth enough times, the earth would be tipped over as far as might be desired.

Instead of being still, the earth is rotating; but this will not alter the effect of the train for, according to the principles which were explained in connection with the mice on the wheel, a rotation of the whole mass does not change the effect of a body moving on it, and after the moving body stops, its rotation is unchanged. Con-

sequently, the train alters the rotation of the earth only while it is moving. In the second place, it would not be possible to build a railroad track around the earth from pole to pole, but the difference in results would be slight if it were turned off to the east or west in high latitudes. For long distances the trains would have to be carried by boats, but this would have the same effects on the earth, for the boats push back on the water as the trains do on the railroad tracks.

Now the question is whether so large a mass as the earth can be changed sensibly by the means available to man. The seriousness of the proposition becomes evident when we find that the total mass of the earth is



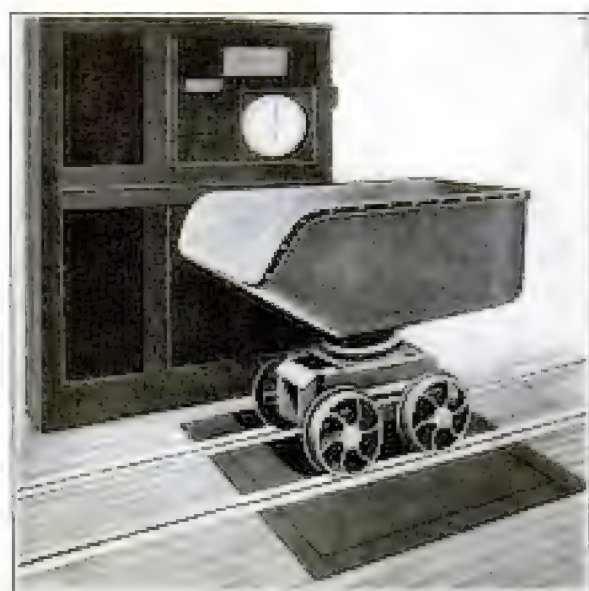
Fig. 2—The Earth might be Tipped Enough to Effect a Change in Latitude, if it were Possible to Run a Train around it Rapidly, along a Meridian between the North and South Poles

six thousand billion billion tons. This number is 6 with 21 ciphers after it. Computation shows that if a hundred trains of 3,000 tons' weight, including the load, were run a thousand miles each day in the manner described, it would require 100,000 million years to change the latitude of North America

one degree. Consequently, it seems that even though scientific men are bold, this is an undertaking which they cannot accomplish. There is more hope that, like the birds, we shall sometime be able to fly from the shores of the Arctic Ocean to the Caribbean with the change of the seasons.

AUTOMATIC TRACK SCALE

A new type of automatic self-registering track scale, which may be oper-



An Automatic Track Scale Which Indicates the Net Weight of Each Load, the Total of All the Net Weights, and Counts the Loads

ated by the movement of a hand lever or wheel, but preferably by a small

of which indicates the net weight of each load, the second records the total of all the net weights passed over the machine, and the third counts the number of loads.

The action of the loaded truck coming upon the scale platform starts the weighing and recording mechanism by closing a clutch, causing a worm which is part of the steelyard to revolve and carry the poise weight until it reaches the balancing point. The instant the beam drops this weight stops traveling, and thus the net weight of the load is instantly and accurately recorded. The poise weight returns at high speed to the zero position as soon as the load is removed, and the scale is ready to receive a new load.

MOTOR CAR FOR HORSE TRANSPORTATION

A well-known fox hunter of Bridlington, Eng., has had a special motor car constructed for the transportation



The Mounts of a Fox Hunter in England are Taken to the Meet in a Special Motor Car

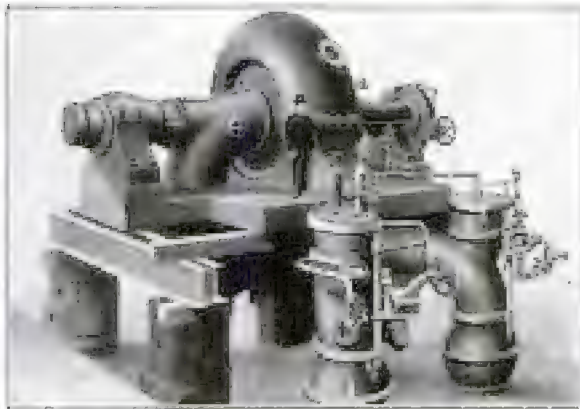
electric motor, is being built by a scale company of Milwaukee, Wis. The scale is fitted with three counters, one

of his hunting horses to Scarborough Hall, near Beverley, for the meet of the Holderness Hunt. The car accom-

modates three horses. Part of one of the side walls is dropped down, and, supported by wooden legs, serves as the gang-plank by means of which the horses enter and leave the car.

THE LARGEST WATER TURBINES

The largest and most powerful hydraulic turbines in the world are operated by the Pacific Coast Power Co., of Seattle, in the hydroelectric development of the White River. Each turbine was designed to develop 18,000 hp. at 360 revolutions per minute under 440 ft. effective head, and 20,400 hp. at the same speed with a maximum head of 480 ft. In actual operation, however, the turbines are each

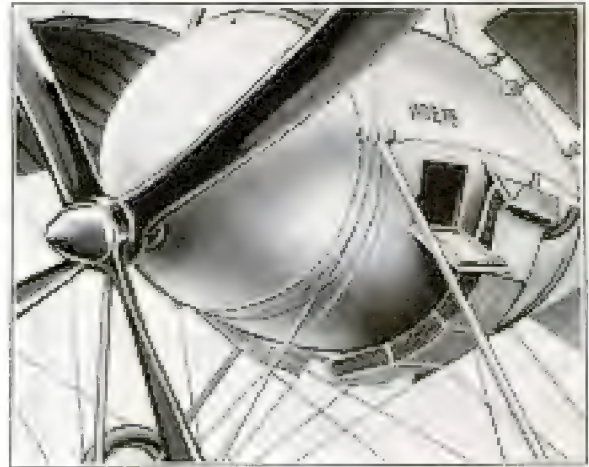


The Largest Water Turbine in the World. An Idea of Its Size may be Gained by Comparing It with the Man

carrying 20,800 hp. under 440 ft. effective head. From a dead short circuit to no load, which requires a full gate motion by the governor from wide open to closed, the maximum speed does not exceed 395 revolutions per minute, or about 10 per cent above normal.

GERMAN ARMORED AEROPLANE

One of the interesting armored war aeroplanes shown at the recent aviation exhibition in Berlin is of the "seagull" type. The interesting feature of this machine is the armored cylinder provided to house and protect the machine's mechanism, the pilot and the "fighting airman," or, in

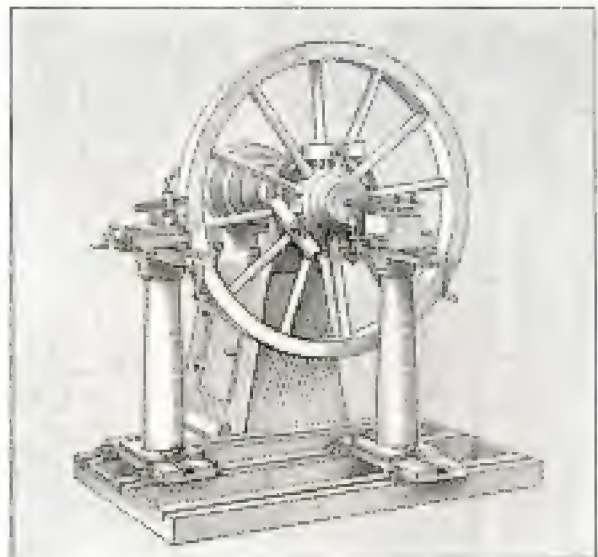


One of the Armored Aeroplanes Developed in Germany and Exhibited at the Recent Aeroplane Show in Berlin

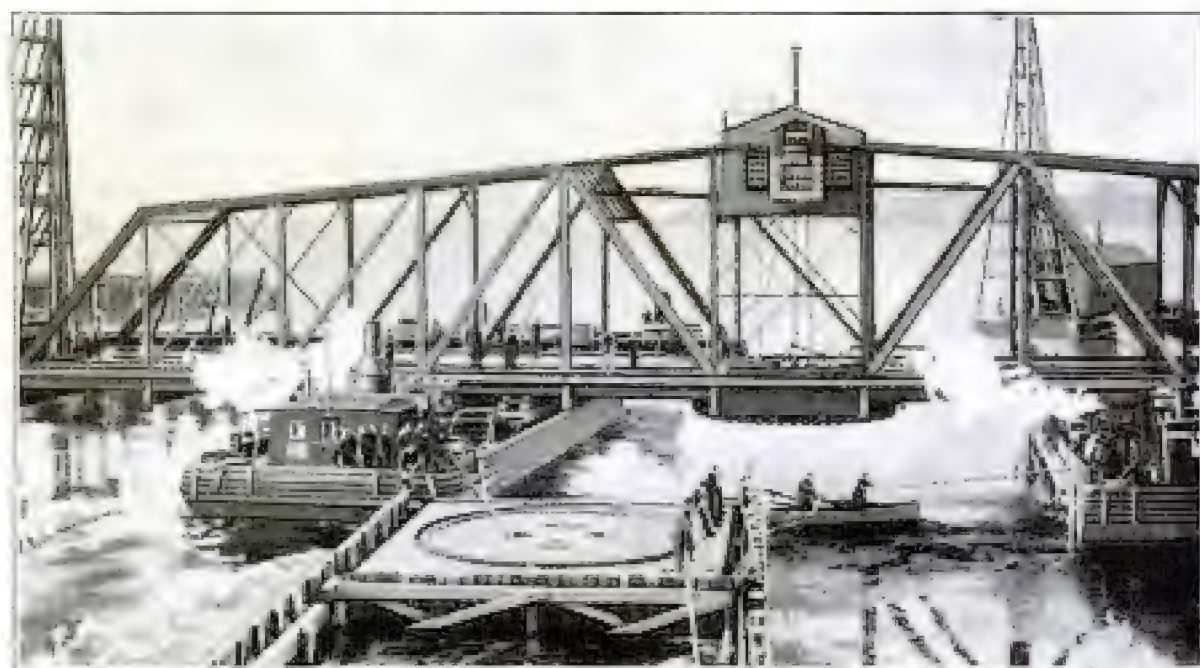
other words, the officer whose duty is to operate the fighting mechanisms of the machine. The armored cylinder tapers to a point in front.

MACHINE FOR TURNING AND BOXING WOODEN WHEELS

An English manufacturing concern has recently placed upon the market an interesting machine, especially designed for turning up and finishing the rims, and for boring or boxing the hubs of wooden wheels. It will handle wheels up to 6 ft. in diameter. Two compound slide rests are provided, one for turning up the rims and faces of the wheels, and the other for



A Machine Which Turns Up and Finishes the Rims, and Bores and Finishes the Hubs of Wooden Wheels



Shifting a 212-Ft. Span, Double-Track Railway Bridge to a New Location on the Passaic River, New Jersey. Service Over the Bridge was Interrupted Only One Day

boring and finishing the hubs. The columns which carry these slide rests can be clamped in various positions on the bedplate, which is attached to the main standard of the machine. They can be easily adjusted and locked in positions suited for wheels of different diameters.

HIGHEST-VOLTAGE DIRECT-CURRENT LOCOMOTIVE

There has recently been built, by one of the large electrical manufacturing companies, a number of high-voltage direct-current locomotives, which will operate on a traction road in South Carolina. These locomotives will be supplied with power from a 1,500-volt, direct-current circuit, which is said to be the highest direct-current voltage used by any electric railway in the United States. The locomotives weigh approximately 55 tons each, and are equipped with four 750-volt motors which have a rating of 180 hp. Two motors will be connected in series, and the combination then connected to the 1,500-volt circuit. It is claimed each locomotive will be able to haul 40 loaded freight cars on a straight, level track at a speed of 20 miles per hour.

AN UNUSUAL BRIDGE-MOVING OPERATION

Recent changes in the line of the Central Railroad of New Jersey between Jersey City and Newark included the shifting of a 212-ft. span, double-track bridge, crossing the Passaic River, to a new location about 185 ft. distant. When the new pivot pier and approaches were ready for the span, preparations were made for the shift and Sunday was decided upon for the work, there being less navigation in the river and fewer trains on this day.

The contractor's forces arrived on the scene at two o'clock in the morning, and pulled out about 30 piles which interfered with the movement of the two 650-ton scows on which the span was to be moved. The scows, filled with about 5 ft. of water ballast, were then floated under the bridge, marks on the cribbing indicating the exact location necessary. Then the 12 sets of blocking were built up, and the water was pumped out of the scows, which, with a rising tide, lifted the bridge clear of its foundations within a very few minutes. Signal and interlocking systems were restored and traffic was resumed at six o'clock in the afternoon.

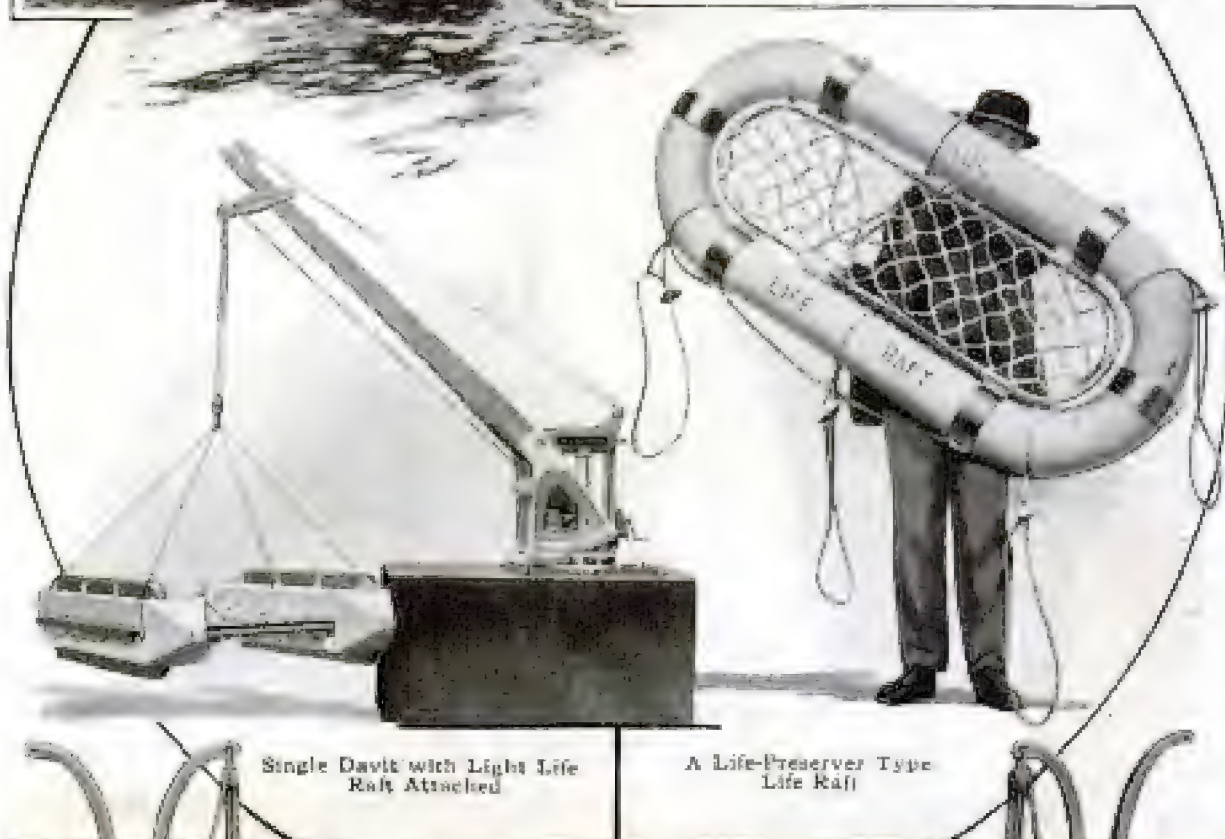
AWAKENING OF INTEREST IN SAFETY DEVICES



Suggestions for improvement in means of life-saving at sea come thick and fast after great sea disasters, and the loss of the "Titanic" is far from proving an exception. Inventors are announcing new schemes from all parts of Europe and America, and there is an awakened interest in devices at present in use. In the above illustration may be seen a number of the collapsible lifeboats provided the "Olympic" immediately after the loss of her sister ship. It was the appearance of these boats, which look frail and unreliable collapsed, that caused the strike of a portion of the crew of the "Olympic." The men left the ship at the last moment, and the White Star Line had to cancel the sailing and transfer the passengers to other ships.

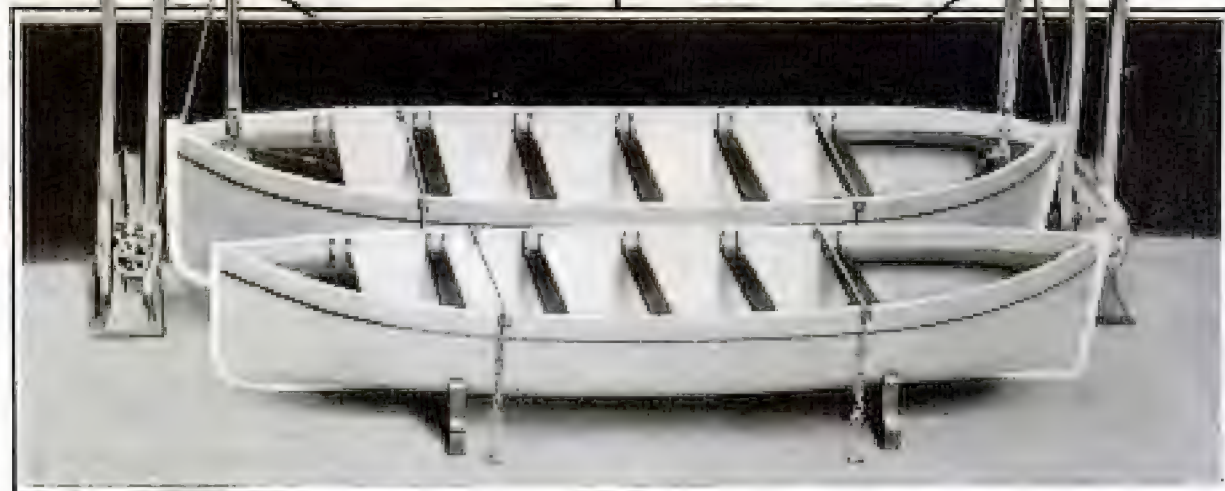


Heavily Loaded Life Raft Given a Test in Boston Harbor, Soon after the "Titanic" Disaster



Single Davit with Light Life Raft Attached

A Life-Preserver Type Life Raft



The "Titanic" was Equipped with More Davits than Boats. In This Illustration is Shown a Scheme for Providing Two Boats for Each Set of Davits



Placing Collapsible Lifeboats on Board
the "Olympic"

The Detachable Pontoon Idea; A Portion of the
Upper Works so Constructed That It would
Remain Afloat should the Vessel Sink



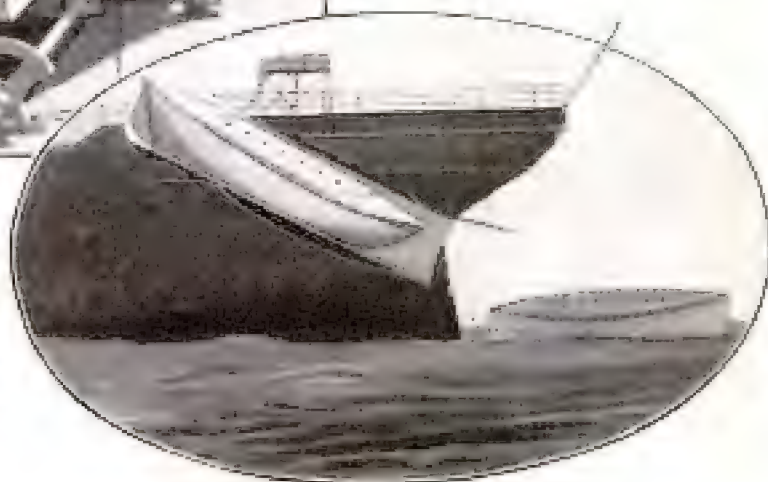
Lifeboat Built Like a Submarine. It can be Steered from Inside or Outside



Opening Out One of the Collapsible Lifeboats. Many Lines Took Them on as "Extras" after the "Titanic" Disaster



The wickerwork lifeboat is one of several carried by the "Batavier III," of one of the Dutch lines. It weighs about as much as the ordinary wooden lifeboat, and carries 16 people. The outer shell of wickerwork prevents injury should the boat strike heavily against the side of the vessel when being lowered into a rough sea. Inside the wickerwork is a wooden shell consisting of three layers of wood with canvas between.



It is suggested that two launching tubes be constructed, one on each side of the stern of the vessel, for the launching of completely covered, motor-driven lifeboats of the type shown in the illustration. All the boats would be disposed on tracks leading along the deck to the entrance of the tubes.



Copyright, 1912, G. V. Brock, Washington

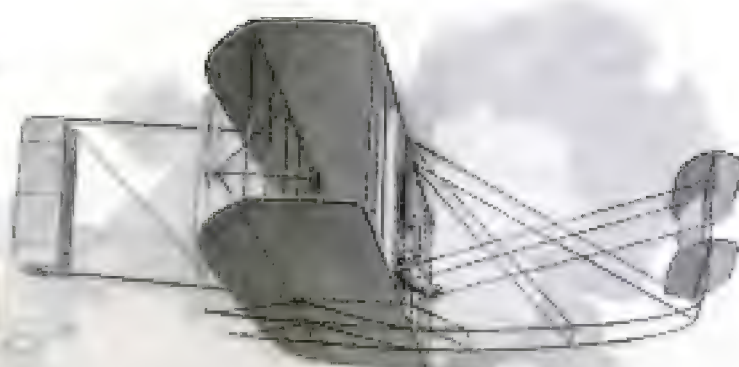
The superdreadnought "Texas," the most powerful battleship of the world yet launched, was slid into the water at Newport News, Va., on May 18th. She has a length of 565 ft., a beam of 95 ft. 3 in., a displacement of 27,000 tons, and a contract speed of 21 knots (24.18 miles an hour). Her main battery will consist of ten 14-in. guns, and the secondary battery is composed of twenty-one 5-in. guns.

His First Public Flight, Le Mans, 1908



Wilbur Wright

In His First
Glider, 1900



WHEN ROTHSCHILD, ROCKEFELLER, AND MORGAN ARE FORGOTTEN



Copyright, 1912, by John T. McCutcheon
Chicago Tribune

WILBUR WRIGHT, INVENTOR OF THE AEROPLANE

BORN APRIL 16, 1867

DIED MAY 30, 1912

Acquiring a Motor Boat

by
George
Fitch



ONE of the greatest virtues of the motorboat is that almost anyone can own one. A motorboat is not an indication of an ungovernably large income. If a man cannot afford to buy a mahogany-skinned racer, with 200 horsepower stuffed into its narrow thorax, he can pick up a second-hand runabout, with an old four-cylinder engine which counts one and skips two until it has run a few miles and is thoroughly hot. If this is beyond him, he can pick up a homemade boat with two cylinders, a cast-iron propeller and a steering wheel made out of an old slat. If even this is too much luxury, he can beg or borrow a rowboat and install in it a mail-order engine which costs \$49.50, and on which he can lavish just as much care and exertion and ingenuity and hoarse, reverberating profanity as if it had cost \$7,000, and were built of aluminum and vanadium steel.

I was told the very best way to get a motorboat is to buy it second-hand. There are many reasons. In the first place the price of a motorboat decreases much faster than its efficiency. When a man has run a thousand-dollar motorboat a year, he has corrected most of its faults and has discovered all of the peculiar kinks in the disposition of the engine. The boat is really

worth more than it was when he bought it, but you can generally coax it away from him for \$400. A man who builds a boat himself—puts \$50 worth of lumber, \$300 worth of engine and \$1,000 worth of time and brains into it—will sell it with the utmost cheerfulness for \$250 just as soon as he has figured out a change of design which makes it imperative that he should build a new boat with a bigger engine. Often, too, you can discover some man who will never learn to run a motorboat because his brain wasn't made to focus on the subject. He is forever starting off with the water drained out of his engine, or with weak batteries, or with no gasoline, or without remembering to turn on the lubricating oil. He cranks his engine for two hours before he remembers to prime it. He spends a summer taking friends out to ride, and listening to their comments and jeers while he struggles with his stationary boat. There are times during the summer when he will sell that boat for \$50 and will think with gratitude of the man who buys it. It is well, therefore, to seek out these men and to linger near them with an expectant eye like an undertaker attending an automobile race.

It is even possible to obtain a boat

without any cost at all. But this is dangerous and the givee should beware. I myself was presented with a \$3,000 boat once. It hadn't cost all of that in the beginning, but the owner had spent that much money on it. He did not like me, so he gave me the boat. I was inexperienced and accepted it. I traveled nine miles in it that summer at an average cost of \$5 a mile, while the former owner sat on the bank and watched me with a grim, but happy smile. He said, the only pleasure he ever had out of that boat was watching me try to run it. In the case of boats you should look gift-horses in the crankshaft, the flywheel, the clutch, the commutator and the stuffing box, before accepting them.

Right in my own town another man has been trying, for three years, to give away a 48-ft. speed hull, built magnificently of oak timbers, with a 2 by 6 oak coaming, and ribs about as thick as corset steels. But he has made no headway, though he swears that it does not sag more than 6 in. in the middle with an engine in, and that the report that he had to feed it gasoline with a force pump is sheer slander.

Suppose you have reached that stage where life is no longer attractive unless you can soak it in gasoline, lubricating oil and river water, and you have determined to buy a motorboat. You have \$250 in cash. Can you sat-

isfy your yearning with this amount? Easily. But don't rush into the business recklessly. Buying a boat is more of a job than buying an automobile, or an aeroplane, or a house and lot. It requires caution. There are diplomatic possibilities to it. There are also other possibilities. You can very easily buy a \$125 boat for \$250. Lots of people do it. It doesn't take any practice at all on your part. Dealing with a boat owner is like dealing with the proprietor of a wall-eyed Connecticut horse. Cash is only the last item in the transaction. Conversation, and a plenty of it, comes first.

To begin with, don't buy the boat yourself. Find a friend who is a boat expert and let him do the negotiating for you, while you stand by with your checkbook hidden, but instantly available, ready to pull it out at the psychological moment, buy the boat and go away with it before the owner gets lonesome for it and refuses to carry out his bargain—for there are few boats which, with all their faults, aren't loved by the owners. More than one man has sold his boat and has bought it back eagerly for \$50 more the next week, after trying unsuccessfully to win the love of a strange and sullen engine in a new boat.

My first boat was a nervous little slim-waisted affair which I, together with another landlubber, bought from a man who had built her himself. He had built her in his cellar and owing to a slight inadvertence in failing to make the boat flexible, he had had to jack the house up off its foundations in order to get her out. He wanted to sell the boat in order to build another one with larger engine space. He had decked



the engine in and, being a fat man, had had to use glove powder in squeezing past it in order to reach the crank. He was willing to sell for \$300, we understood, and we were willing to buy for that sum, having sequestered it from the voracious cost of living after a hard struggle. But when we told our plans to our friend Green, who knows motor-boats as grandmothers know babies, he scoffed loudly. "It's lucky you innocents came to me," he declared. "I would never feel innocent again if I let you go off by yourselves and buy that boat. Give me your money and come with me. I'll buy it for you."

We followed Green up to the dock where the boat lay, and found her owner near by. Waving us aside, Green opened negotiations. He began cautiously, almost stealthily, approaching the subject from the rear, and with no indication of any interest in it whatever.

"We just dropped down to look at the boat," he said casually. "These queer old-timers are sort of interesting nowadays." He poked around her seams with a pen knife. "Pretty rotten, isn't she?"

"She was new last winter. I built her myself. I've put over \$22 of brand new equipment in her this year," said the owner promptly. "She's the steadiest boat on the river."

"Um," said Green, inspecting the engine. "I suppose she's as steady as any other dock. You don't presume to run her with that mess in there, do you?"

The owner was grieved. "Run her!" he shouted. "Why, man, she ain't missed a pop all summer. She's got a world of power. That engine has never failed to run. A quarter turn will start her every time—"

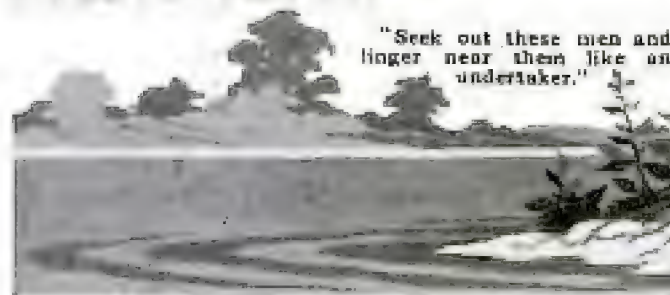
"You must have run her about 10,000 miles," said Green, examining some more. "That engine is on its last legs. There isn't a bearing left in her. She hasn't got as much compression as an old corset. It will take one hundred dollars to put that engine in shape, and it wasn't worth that new."

"It wasn't!" yelled the owner. "I paid \$225 for that engine and I got a dealer's discount at that; and I've put in a clutch and a new set of coils and a magneto since then, and a new storage battery—"

"You'd have done better to put in a horse," said Green, cruelly. "Where did you get your idea for this model? A houseboat would look like a racer beside this scow. You must have dreamed this plan after a lobster supper."

"She does eight miles an hour all day long with that little bit of an engine," snorted the owner, instantly abandoning the machinery and coming to the rescue of the boat. "She's the best model on the river. If I had any power in her she'd make 12 at least."

"Nice stern you've got," said Green. "Sort of a standing invitation for a sea to come aboard and make itself at home, eh? No wonder you built a chicken coop over your engine. You'd have to bail this thing with a steam pump in a sea. What do you want for her?"



By this time we two real buyers were looking nervously for a street car. We didn't want a death trap. We were grateful to Green, but we wanted to go away. The owner might try to give us the boat and we might be tempted to take it.

"She stands me in seven hundred, not counting my time," said the owner. "I wouldn't sell her for anything, but a fellow has given me a big engine and I want to build a speed boat. I'll take \$300 cash, and I'll paint her up first class."

"Three hundred!" yelled Green. "Three hundred for that ark? Why, it would cost that much to put her in shape so that she could beat a duck in a fair race."

The owner was pained. "Ding it! Man, she's in perfect shape," he protested. "I've just overhauled her. She's got brand new cork cushions, too, and a searchlight."

"She's got to be caulked and that rudder gear wouldn't be safe to use on a butter boat," said Green.

"A man offered me four hundred for her last week," said the owner, "but he wanted to use her for towing sand-barges and I wouldn't let her go for no such purpose. She's a bargain at three hundred. She's got a full charge in her storage battery and a nice flag."

"That gasoline tank's tin."

"The feed pipe's lead."

"She's hogged in the middle."

"I just put a new rudder on her, too."

"I'll give you \$150, and not a cent more," said Green. "We couldn't use her to run with, but we might get some salvage out of her brass."

"Two-seventy-five's my bottom figure. There's a fellow from Pekin wants her for three hundred, and he's coming tomorrow. She's got copper paint on her bottom."

"Yes, and that's about all the bottom



"He had built her in his cellar, and, owing to a slight had to jack the house up off its

she's got," said Green. "I'll give you \$225."

"Done," said the man with paralyzing swiftness. "I've got a blank bill of sale right here."

We watched proceedings somewhat dazed and made out the check as Green ordered. Then we shook hands over the bargain, and after he had left we took Green by the throat and asked him why he had bought a prehistoric death trap for us?"

"She's a peach of a boat," said Green, joyfully. "She's worth \$400 at the least."

"But she leaks, and her engine's no good, and she's got no bottom!" I objected.

"Shucks," said Green. "She's the best bargain on the river. But if you'd believed all he said you'd have had to pay \$500."

Gradually Green's method dawned on us and we were properly jubilant. "We've got \$75 left to run her on this



inadvertence in failing to make the boat flexible, he foundations in order to get her out."

summer," I declared joyfully. "We intended to spend \$300 on that boat."

"So you will," said Green menacingly. "That's just about what she will cost you."

Later we found that he came within five dollars of the truth. For when we went to get the boat we found that the owner had artfully removed such things as had not been mentioned in the bargaining, including all the tools, the acetylene tank, the batteries, the anchor, the side lights and the life preservers—and also that the boat had no propeller, and that the timer was a broken reed. But aside from that she was a very good boat and we enjoyed her frabjously.

It is astounding how much boat can occasionally be bought for a little money. Later on, my partner and I bought a 30-ft. cabin boat with a good, heavy-duty 8-hp. engine in it, magneto, storage batteries and kitchen outfit for \$200. The builder had put oak

frames and brass screws all through it, and had built it to ram battleships. But she was not malaria proof, so he sold her to a friend for \$600. This friend, who was eminently fitted for buying old masters and costly books, tried all one summer to make the engine run with a disconnected wire, and will not, even now, allow us to mention the boat in his presence. We have since run the boat upward of 1,500 miles during two seasons, at a total cost for repairs, dockage, improvements, and gasoline, of \$300.

That works out at the rate of 20 cents a mile, which is not exactly cheap traveling. But there is one comfort. You can travel all day in a boat of this sort and not use up more than 60 miles of the 1,500—and by the time you have towed the boat in from her anchorage, have made necessary repairs, have coaxed the engine out of the dumps, and have run five

joyous, sea-splashed miles, you have put in a very pleasant afternoon for two, or four or six people—which is cheaper than going to vaudeville or baseball. We always figure on four miles for each gallon of gasoline—it takes more power to plow through water than to run over land—and on long trips we allow our guests to pay for the gasoline, and also to carry it down to the river from the supply stations. It gives them a sense of responsibility and personal interest and is really a favor to them.

The cheapness of second-hand boats, however, is only equaled by the hideous cost of engine repairs. I have learned to look at engine experts with fear and to shudder apprehensively whenever my engine develops any affection which may call for an operation. A year ago we wanted to have the bearings of the Siwash engine overhauled. The proprietor of a machine shop came up with a helper and

a horse and wagon—each separate item of the above drawing 80 cents an hour—and took the engine away to his lair. We tried several times to rescue it, but unsuccessfully. It had been dismembered and for a month it lay around the machine shop in fragments, while at odd times, when business was slack, the proprietor, or his assistant, or the drayman, or the delivery boy would go and do \$1.60, or \$2.40, or \$4.80, or \$6.40 worth of work on it. When it came back the bearings had been tightened, the flywheel loosened, the spark plugs polished, the crank-draw filed, the piston rings replaced, the gasoline connection lost, and the timer manicured. The bill was \$43.20 and when the thing refused to run the proprietor declined to come up and

look at the corpse for less than 60 cents an hour. He knocked off the 20 cents as a concession to old customers.

Since then we have made our own repairs and we have adhered rigidly to one rule. We do not repair the engine as long as it will run. When it ceases to run and makes funny noises in its abdomen, and spits blue smoke and flames at us, and finally becomes cold and dead and limp in the crank-shaft, we reluctantly hold a post-mortem and allow an expert to enter the boat, under heavy guard, and with the threat that if he attempts to repair the water line, and the horizon, and the flag staff, over and above the specified job, death on the spot shall be his portion.



COMPULSORY DATING OF AUTOMOBILE TIRES

Bills have been passed, or are pending, in several of the state legislatures, notably those of Minnesota, Georgia and New York, to make the dating of automobile tires compulsory. The principal clause of the New York bill requires that "no person or corporation shall manufacture, sell, offer, or expose for sale a tire for use on a motor vehicle, unless the date when such tire was manufactured shall be impressed or branded upon the material whereof

such tire is constructed, or otherwise indicated by label securely attached thereto. Every person or corporation violating this section shall be liable to a penalty of \$50 for each violation."

An amendment tacked onto the bill, however, made the bill a joke, according to some critics. This amendment relieves the manufacturer from any responsibility for the dating of the tires and places it upon the retail dealer, who has no means of knowing the date of manufacture. This amendment also allows the dealer to apply the date with a rubber stamp.

COMMENT AND REVIEW

AFTER long deliberation and much experimenting England has finally acknowledged the necessity of the aeroplane in modern warfare, and has placed its seal of approval thereon with an initial order for 60 machines. This number will be increased to 100 just as soon as a sufficient number of sky pilots can be trained to navigate them. To fully appreciate the importance which this arm of the service has already attained one must note the appropriations for the current year, by the three great continental powers. France will spend \$6,250,000—a sum sufficient to build a very fair warship; Germany, \$3,500,000; and Britain, \$1,500,000. A total for three countries of \$11,250,000, thus illustrating the increasing and high cost of military living.

*Aeroplanes
Come
High*



THE floods which have swept down the thousand and more miles of Mississippi Valley this year have been unusual because of the more than ordinary loss of life and property. Each year, with patient regularity, about so many thousand settlers along the great watercourse leave their homes and betake themselves and families and live stock to points of land above normal high water. When the flood has passed they return to water-soaked homes, in good condition to contract the various types of sickness which always follow in the wake of an overflow. Even such a deluge as the long-to-be-remembered one of 1912 fails to dislodge any considerable number. Man has much of the habit of the wild animal in this respect, as shown in hamlets and towns rebuilt where the avalanche, flood, eruption, tidal wave and other convulsions of nature have blotted out existence. And in all these instances there is little or nothing the immediate sufferer can do to prevent a recurrence.

*Turn
Waste
into
Wealth*

Of the disasters mentioned, the flood alone is capable of prevention, and the remedy lies not where the flood is found, but back at its many sources. The undertaking in the case of the Mississippi is so vast that prevention is not likely to be attained for many years, though eventually it doubtless will, through an economic condition. If a sufficient number of controllable tributaries should be dammed to hold back one-half or even one-third of the water released each spring, it would not be difficult to handle the volume flowing via the Mississippi with comparative safety. The cost of this control would run into vast sums, and therefore can be accomplished but slowly. If, however, the entrained waters were released through turbines and thus made to produce power, and the same water used over and over again, a sufficiently large revenue might result to meet, or nearly so, the interest on the cost of such construction. And if this direct revenue could be supplemented by a part of the saving from what would otherwise be a large loss, the sum total should make the undertaking at least self-supporting. Obviously the plan could only be effectively worked through Federal control with the cooperation of the several states involved; but with the Panama Canal as an example, the project is far from impossible or impracticable. Perhaps the idea also contains a suggestion as to what to do with our convicts. In work of this nature they could be massed and kept employed for months or years in one place, under conditions which would be alike favorable to the State and to the prisoners.

A BILL was introduced in Congress the other day which confirms the growing belief that what this country needs in its legislative halls is fewer politicians and more men of practical business experience. The bill referred to is for the appropriation of One Hundred Thousand Dollars with which the Secretary of the Navy is to "ascertain whether the target practice of warships and the use of explosives dropped from airships" may supply a means of destroying icebergs. Even the freshest recruit on board ship might reasonably be expected to hit the April ice field which was reported to be 12 miles wide and 65 miles long; but with such a target as that the best gunners and the heaviest shot could effect about as much damage as a small boy with a bean blower. However the bill to bombard bergs had not advanced to the point of burning powder when these lines were written.

*Bill to
Bombard
'Bergs*



THE report of the Senate Committee on the "Titanic" disaster is satisfying to our own people. It should cause those British journals which have sought to pour ridicule upon the investigation, and especially upon Chairman Senator Smith, to realize how childish they have acted. The report does not hesitate to place prime responsibility where it belongs—upon the unfortunate Captain Smith—but does it in no resentful or carping manner. The tenor of the report is to so present facts, based on undisputed testimony, that hereafter the passenger on Atlantic liners shall be safeguarded to the fullest extent possible.

*Senate
Committee
Report*

The British investigation, which is still in progress, started out with the evident intention to minimize responsibility and to whitewash the management, officers and crew. The results of the investigation on this side had, however, been published in England, and public opinion so strongly insisted on having the truth that after a few days of nibbling at the edges, the court ventured on fairly thorough work. It is evident, however, that in the absence of public information, made possible only by our Senate investigation, the full measure of incompetence, unpreparedness, and utter disregard of the rudimental laws of safety would never have been revealed.

The insults heaped upon Senator Smith by the British press serve but to emphasize the service he has done humanity in exposing conditions little dreamed of, and which, now known, will result in great reforms.



THE inestimable service which the wireless rendered in the rescue of the "Titanic" survivors is alone sufficient to immortalize the name of Marconi; in the confusion and excitement of events the daily press paid scant praise to the great inventor, who already has saved nearly 5,000 lives. It is very apparent, however, that the continued employment of beardless youths in the wireless station of passenger liners must cease. Positions involving so momentous responsibilities are not in the nature of things fully realized by boys in their teens. This is one of the reforms international conference must secure, and should require not only

*Wireless
Needs
Men*

examination as to wireless ability, but even more as to fitness of operators. That the mere sending or receiving of wireless is anything but difficult is attested by the thousands of grammar and high-school boys who are already operating for pleasure, but the qualities of mature judgment and endurance are a prime necessity. Moreover, a reasonable number of Atlantic steamers should, when crossing, be required to maintain unbroken attendance in the "spark house," not for their own advantage, but to provide for the receiving of distress messages from other vessels.

If governments should now impose upon ship stations conditions which seem onerous to steamship companies, the penalty is not undeserved. Hereafter it must be impossible for even the president of a steamship line to absolutely throttle the voice of wireless. Imagine a city of 2,500 souls swept with sudden disaster, with 1,800 residents dead or dying, and the mayor of the town or the president of the telegraph company controlling the one telegraph wire and withholding all details for four days!

Since the above lines were written the Senate of the United States passed a bill, without discussion and without one dissenting vote, requiring two or more wireless operators on every vessel carrying 100 or more persons—crew or passengers—landing at our ports. One operator to be always on duty, night or day. Other countries will doubtless soon enforce the same requirement.



AND while at-sea stations are being reorganized on a better basis, the question of auxiliary power to operate the wireless should not be overlooked. In the case in mind the electric plant was successfully operated up to the last moment. Had the ship swung on to the iceberg a second or two later than she did, the engine room instead of the forward compartments would have been flooded, immediately extinguishing all the lights and hushing the voice of the wireless. It may be recalled that this danger to the ship's station was commented on in these pages two years ago, at which time it was urged that an independent gas-engine power be provided on the upper deck in order to secure telegraphic communication to the very last instant. That this equipment will hereafter be secured seems likely, either by law, or voluntarily, as in the case of the "Megantic" now building.

*Auxiliary
Wireless
Power*



WHILE on the subject of wireless it is interesting to note the progress being made to extend the inter-continental service. Our own government through the Navy Department is already constructing the longest chain of wireless stations in existence. This system will permit Washington to communicate with our own stations in Alaska, the Panama Canal Zone, San Francisco, Pearl Harbor, Hawaii; Tutuila Island, in the Samoas; and Guam, and Luzon, in the Philippine Islands. Each of these stations is to have a sending radius of at least 3,000 miles.

*World-
Wide
Wireless*

For commercial service the Marconi Company have planned a series of stations which will entirely encircle the globe; and the work of construction will be begun in the near future. An American steam-

ship company has also announced its intention to proceed at once with the erection of three tower stations which will connect our Gulf coast with South America, thus furnishing communication with land stations there, for the first time. In a few years all the continents and the more important islands of the sea will be linked with an invisible network of communication. What a story of scientific and mechanical progress has been written from the days of the Spaniard Salva, who in 1795 dreamed of a submarine telegraph, to those of Morse in 1866, and now to the realization of a world-wide wireless system!



A CERTAIN new depot, recently completed in Chicago, is a wonderful exemplification of painstaking study to provide the traveling public with every possible convenience. Roomy elevators toss the passengers swiftly from street to train floor, bureaus of information supply an endless fund of knowledge, electric lights on stairway landings prevent stumbling, and of course restaurants, telephones, telegraphs, cabs, drug store, news stands and the like are convenient and ample. Even the large space set apart for immigrant passengers traveling second class must appear like a palace to these people, with its white tiling everywhere, and rest rooms, restaurant, baths, laundry, hospital, and, in fact, no reasonable want unprovided.

*To Please
the
Public*

But the thing which most impressed me was not the magnificence of the building which cost a lot of millions, nor the beautiful marble, nor the high arched waiting room. It was a plain mahogany box, fastened to the wall where everyone who goes in or out can see it. And on this box are the significant words:

"TO PLEASE THE PUBLIC

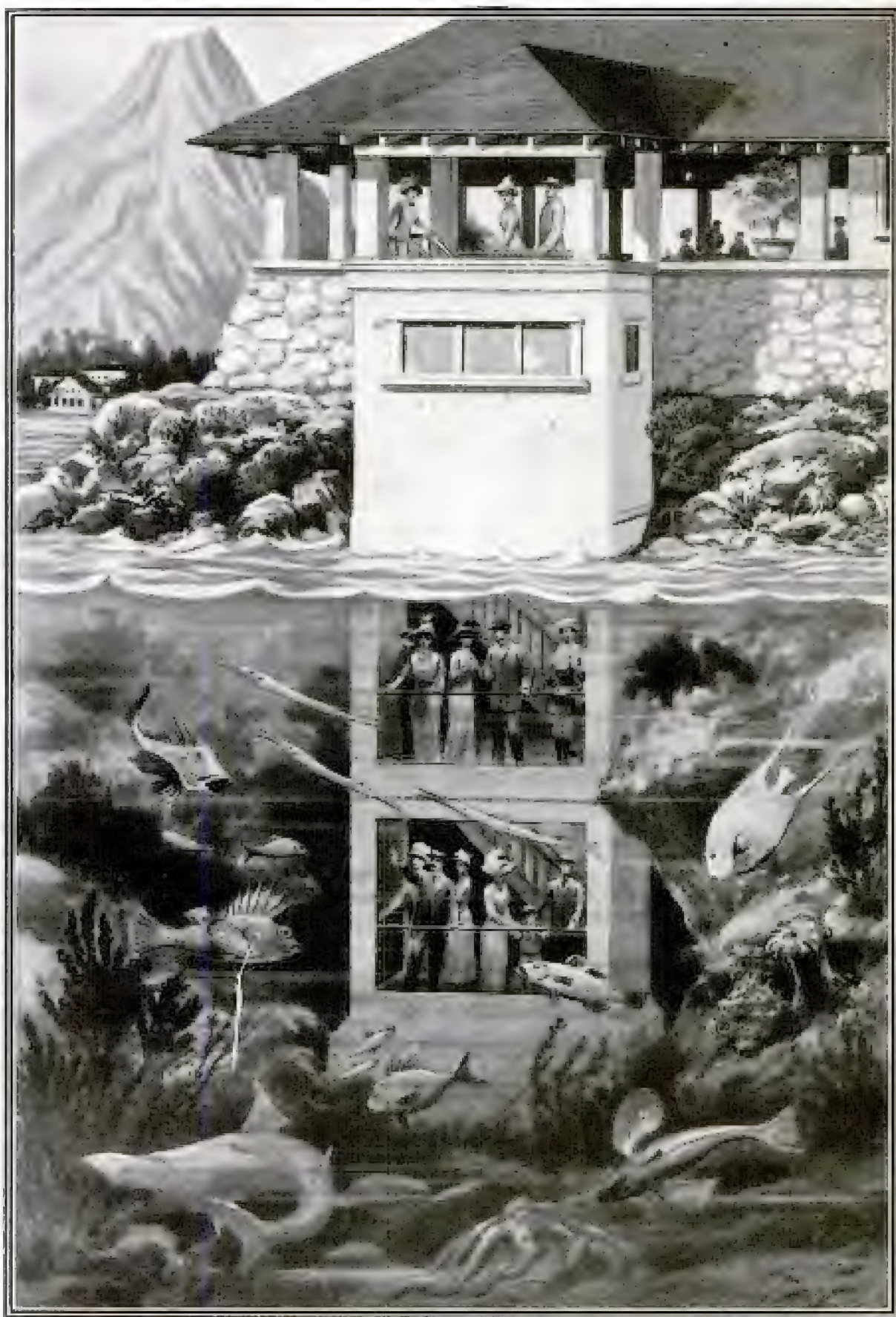
Drop your suggestions in this box."

Having supplied everything that the best engineers and builders in America and Europe could suggest, or money can buy, there is provided this simple, dignified invitation to its millions of travelers each year, this last word of invitation to suggest some improvement unthought of by its own officers and employees.

What a contrast the little mahogany box of today offers to the expressed policy of the greatest railroad owner of 40 years ago, who said, "The Public be——" Well, you know what.

H. H. WINDSOR





Business men of Honolulu, Hawaii, are preparing to build a modern hotel on the reef off Diamond Head, where the naval station is located. The most interesting feature of the hotel will be a glass-walled shaft which will extend down into the sea, allowing the guests to descend and observe the wonderful sea life in that locality.

AN UMBRELLA CARRIER

An ingenious carrier for umbrellas and parasols, designed to prevent the loss of this often forgotten article, has been invented by an English woman. It is a hanger made of cord designed to be passed around one shoulder, and the umbrella or parasol is hung from it in somewhat the same manner as a sword.



A RESOURCEFUL "ENGINEER"

The following story has been taken from Electrical Engineering, and is said to have been sent by a correspondent in Australia: There is a little town of 2,000 people, away back in the bush of New South Wales, which can boast of an antiquated electric-light station,

under the charge of a "chief electrical engineer," appointed by the aldermen of the district, and simultane-

ously performing the duties of stoker, wireman, and engine driver. He is also the leading and only electrical contractor in the town, and for some years past has reaped a very handsome income by selling metal-filament lamps to the farmers and other consumers at about 6s. each.

It happened not long ago that one of the farmers came to town, and was very much struck at the ridiculously low price for which he could obtain metal-filament lamps in the city, and on his advice the enterprising concern from which he obtained his lamps sent a traveler up to his town, and, in the absence of the previously mentioned "chief electrical engineer," disposed of some few hundred lamps at the ordinary selling price.

When our friend returned to his official duties, he realized that the sale of his expensive lamps had been considerably handicapped. But he was previously a marine engineer, and we all know that marine engineers are not to be easily cornered. The same evening, therefore, he thought it advisable to boost up his voltage, until every lamp in the town popped off. The next morning he took a push cart around town heavily laden with his own lamps, and told the poor farmers that if they would speculate on these inferior cheap German lamps they would have to stand the consequences.

SNAIL WALKS SAFELY OVER RAZOR'S EDGE

That snails can pass over such sharp implements as a razor's edge without the slightest harm has been demon-



A Snail Crawling Over the Sharp Edge of a Razor Without Cutting Itself

strated by a French scientist in the course of his study of these creatures, which are so well equipped for travel that they can move over surfaces exceptionally dangerous to seemingly better protected animals.

The snail walks with the whole under surface of its body, and is provided with means to lubricate the road on which it travels. A peculiarly complex system of muscles enables it to cling in any position to the smoothest objects. In lifting itself over the razor's edge it clings with the hind part of its walking surface to one side of the blade, and extends the fore part and bends it down onto the other side

without touching the edge, thus accomplishing without harm what would naturally seem impossible.

CONCRETE ARCHES FORM BASE FOR TOMBSTONES

An unusual and interesting application of concrete has been adopted in the old cemetery at Portsmouth, N. H., to make a marshy section of ground available for graves. A section of the eastern edge of the cemetery, which is not far from a salt marsh that stretches in from the sea, was recently purchased by the trustees of the Home for the Aged. This land had long been considered too low and wet for burial purposes, but the trustees made it available by sinking concrete columns to bedrock and resting concrete arches upon them, there being nine rows, and nine arches to each row. At the lowest point of the slope the arches rose to a height of 6 ft. above the sur-



Rows of Concrete Arches Erected in Low Ground of an Old Cemetery at Portsmouth, N. H., as Grave-stone Foundations

face, requiring a considerable earth fill to raise the ground level to a height of 6 in. above the rows of arches. The arches will be used as foundations upon which the gravestones will rest as needed, and it is calculated that the foundations so constructed are of sufficient depth and weight to withstand upheaval by the frost.

THE MOTOR CAR AS A COW PONY

Probably the most remarkable demonstration of an automobile to a prospective purchaser of the machine was made by Gordon Kelly, a Los Angeles motor enthusiast, to a Southern California ranch owner. The latter was interested in cars, and Mr. Kelly took one out to his

ranch to show what it could do. While driving it over the land, the rancher suddenly noticed that one of his half-wild cows had strayed from the herd and was making for the hills. None of the cowboys happened to be in sight and the owner, Mr. A. V. Jones, was annoyed at seeing his animal escape.



The Automobile as a Steed for the Cowboy: Reeling a Cow from the Front Seat of the Machine

The motor salesman was equal to the emergency. "I will help you get that cow," he said, "if you will handle the rope." As Jones was a lariat expert, and happened to have a coil of rope in the car, he agreed. The automobile was speeded up and bumped over the rough ground at a pace too great for any wild cow. The animal was overtaken, and Jones whirled his noose in true cowboy style, catching the creature by the neck. Mr. Kelly, at the wheel, did his part like a veteran cow-puncher and brought the car around at the proper moment to throw the animal, which, once subdued, returned quietly to the herd.

Naturally the rancher was delighted at this exhibition of the car's adaptability to ranch life, and promptly made out his check, thus becoming the owner of the first "gasoline broncho" on record.

TIGER'S HEAD OUTLINED IN CIRCISSIAN WALNUT

A piece of Circassian walnut veneer, the natural markings of which showed one-half of a tiger's head, was recently discovered in a New York veneer plant. A long search was made to find



A Tiger's Head in the Natural Markings of Circassian Walnut Veneer

the duplicate, but only a near duplicate of the perfectly symmetrical veneer could be found. The two pieces were mounted as shown and placed in a window. It has attracted much attention as a freak of nature, and an offer was made for it by a man who intended presenting it to Tammany Hall.

NEW TYPE OF BLOCK SIGNAL FOR COLD WEATHER

During last winter the various railroads experienced considerable difficulty in operating their block signals with any degree of accuracy, on account of the accumulations of ice and frost on the signal lamps. An inter-urban electric railway company, operating in northern Ohio, claims to have overcome the difficulty and solved the problem of operating block systems in cold weather by the use of a new type of signal.

This new signal is arranged to be lighted by a 25-watt tungsten lamp, which in this particular case was supplied with electrical energy from the trolley wire, a suitable resistance being connected in series with it. The switch-controlling mechanism is operated by a small motor, which also derives its energy from the trolley wire, and is so designed that it will operate safely through a wide variation of line pressures. The heat generated in the lamp and the resistance in series with it, are ample to prevent the accumulation of ice on the lenses of the lamp and the switch-operating mechanism. Of course, in the case of a steam road, it would be necessary to install batteries of considerable capacity at different points along the road to supply energy to the lamp; and to provide sufficient resistance to bring about the desired results.

According to the law, as decided by the courts, an oil company can post a location notice on a tombstone in California, and sink an oil well within 20 ft. of the graves, even though the land be held under a federal patent.

FAMOUS SAINT MARK'S CAMPANILE RESTORED

The famous Campanile of St. Mark's, Venice, which fell to the ground in 1902, crushing with it the Sansovine Loggia, is now restored after 10 years of work. The new Campanile is in every detail of appearance like the old, but is constructed in the light of modern science and possibly with more enduring skill.

The old Campanile di San Marco, like others of its kind, was the work of many generations, having been started in the year 888, added to in 948 and 1148, and completed to the platform in 1170. Its foundation was a rectangular base of Istrian stone, and its brick walls tapered gently up to a height of 200 ft., in a series of eight stories pierced with windows. Above the platform rose an open loggia of marble, 50 ft. high, being the actual belfry, wherein hung five great bells of bronze.

The Famous Campanile of St. Mark's, Venice, as It Appeared a Short Time Previous to the Completion of Its Restoration



The high-pitched roof of the belfry was surmounted by the metal figure of an angel, 16 ft. high, the total height thus being brought to 325 ft.

AN UNUSUAL HOTEL ANNEX

An apartment hotel which stands on the top of a steep hill in Los Angeles is to have an annex, the construction of which turns ordinary construction methods topsy-turvy. The present building is four stories high and is reached by steps winding up a massive stone retaining wall. In the addition of an annex the retaining wall is to be removed, a section of the hill, 52 ft. wide by 40 ft. in depth, is to be cut out, and in the space thus created will be erected a five-story building that will just reach and partially support the second floor of the original building. From the front the completed structure will present the eleva-

tion of an eight-story building, with the upper stories set back some distance from the cornice level. The roof of the addition will constitute an open terrace in front of what will be the sixth story.

CURIOUS "FREAK" OF A BULLET

In shooting with a 38-caliber automatic revolver at a target made of a block of wood, 10 in. thick, the bull's-eye of which was a tin button, such as is used in fastening



tarred paper roofing, one of the marksmen succeeded in hitting a shingle nail, which was used to fasten the button, almost exactly in the center. Upon splitting the block of wood to recover the bullets, it was found that the bullet which hit the bull's-eye had penetrated $8\frac{1}{2}$ in. into the wood, and, in its course, had enveloped the shingle nail and taken it with it. The manner in which the bullet enveloped the nail is shown in the illustration.

WHOLE CITY TO BE HEATED BY ELECTRICITY

Plans are being formulated to heat electrically the dwellings and business houses of Stavanger, in Norway, and the officials of the electric plant at that place have applied to the city council

for permission to carry out their proposed undertaking. The population of Stavanger is about 30,000 and there are ample water-power facilities available to develop at least 25,000 hp. for electrical purposes. As it is planned at present, no customer will be allowed a greater consumption than 100 hp., and owing to the exceedingly low cost of production, the price per horsepower for one year will be only about seven dollars. The city officials are also considering the advisability of heating the public buildings by means of electricity.

TY COBB TWICE; A UNIQUE PHOTOGRAPH

The photograph of the Detroit Tigers here reproduced has created much comment, in that Ty Cobb, considered one of the greatest, if not the greatest baseball player in the world today, appears twice. The way in which he succeeded in appearing twice, however, is a very simple matter. The camera used to take the picture was of the panorama type, which was made to revolve slowly from left to right, exposing but a small portion of the film at a time. Cobb stood third from the left end of the line of players shown in the illustration when the camera started and as soon as the lens had passed him he sprinted around back of the camera and was standing at the



Copyright, 1912, Duines & Co., Detroit

A Unique Photograph of the Detroit Baseball Team



The Epsom Race; after a Painting by Géricault

right of the line before the camera reached the end of the picture.

Some of the baseball fans surmise that he did not like the serious expression of his face when the camera first caught him and sprinted around to the other end to get his smile into the picture. Others remark that he is most of the team anyway and in full justice might have been taken four or five times instead of only twice.

MOTION IN ART AND IN REALITY

How far the means of visualizing swift motion usually adopted by painters differs from the actual performance in reality is well demonstrated in the accompanying illustrations. One of these is from a painting of the Epsom Race, one of the famous annual racing classics of England, painted by Géricault. It cannot

be denied that this painting conveys an impression of speed, yet there is not one attitude of the horse as shown



Motion Picture of a Galloping Horse

by the motion pictures that is anywhere near like that of any of the horses in the painting.



In Which Ty Cobb Makes His Appearance Twice

A JACKDAW THAT GOES TO SCHOOL

An unusual companionship between a small boy and a jackdaw exists in



The Jackdaw in His Master's Arms

the village of Upton, Berkshire, Eng. The boy is Joseph Butler, aged 12, and



Perched on the Desk and Looking Wise While His Master Recites

the jackdaw, which is now two years old, and which was found by him after falling from its nest while young, is never satisfied to let him out of sight. The bird is so fond of the boy that it goes to school and to church with him, pecks other boys who fight him, sits by him at meals, and sets up a mournful cawing when kept away from him. For over a year now the bird has gone to school with its young master, sitting quietly on his desk. The teacher allows the bird in the school, since, if she kept it out, its caws as it fluttered around the schoolhouse would disturb the other children.

NETTLE A SUBSTITUTE FOR COTTON

In the last few years a great many experiments have been made on various materials in an effort to find a suitable substitute for cotton. The most promising plant, on account of the strength of its fiber and its ready growth under very adverse conditions together with its large yield per acre, is the common nettle, and by a recently invented method of treatment which seems to have solved the problem, it now gives us a fair substitute for cotton in many of its uses.

In the new treatment the dried nettle stems are first boiled for a short time in dilute soda lye, which loosens the fibers from the woody stems. The fibers are then separated from the woody portions by means of brushes in a special machine and subjected alternately to boilings in dilute lye and thorough washings. The resulting product is a yellowish mass of fine fibers, which are entirely free from gum and may be bleached, combed and spun into yarn. This yarn is claimed to have the smoothness and softness of flax, and a strength greater than that of hemp; may be woven into damask, or used, alone or in combination with other threads, in making ribbons, upholstery, and numerous other fabrics.

Song of the Dynamite Blast

By J. W. FOLEY

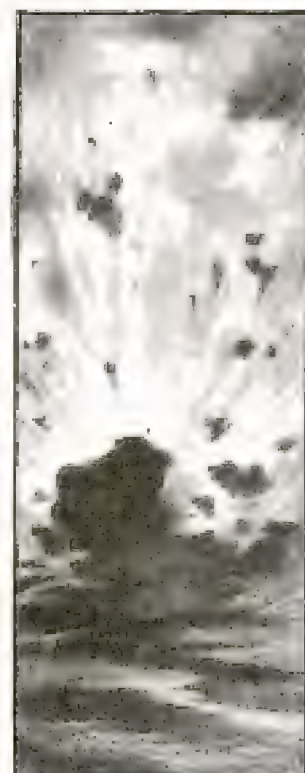
I SLEEP, and I am still as death,
Inert and hurtless as a stone.
I wake, and in my flaming breath
Are rock-bound temples overthrown.
Caress me, and I lie as still
As when the adder slumbers deep:
But strike me, and I rise to kill
Who wakes me from my torpid sleep.

Asleep, I have no voice or will,
But strength that lies in me unspent.
Awake, I rend and maim and kill
Who may not fly. By me were rent
Those granite rocks, that long defied
The puny strength of man to mar,
I spake, and they were brushed aside
Like leaves, and split as faggots are.

From out my wakened throat a roar:
From opened eyes my flame-shot glare;
My arms hurl thunderbolts that score
The steel, and toss them high in air,
Those great, gray rocks, like pebbles flung
From slings; I crush them at my will,
And with a demon's angry tongue
Exult my ruin—and am still!

My putty-mass is soft and sleek
As is the drowsy tiger's paw;
But rouse me, and red scars I wreak
When I unsheathe my hidden claw;
I cleave the granite, twist the steel,
And lay the temple in debris;
I crush the rib and smash the keel,
For ruin hides, but hides in me.

Bind me with manacles of steel,
House me in narrow walls of stone;
Gird me with granite thongs, and feel
My sinews quiver: and the bone
And brawn of me in fury lay
In wreck what prison walls may be.
I smite, I strike, I split, I slay—
And I am—as I would be—free!





Young English Miners Playing Sand Billiards During the Recent Strike

RAILWAY SIGNAL MAN HAS BABOON ASSISTANT

Through an accident on the Transvaal Railway this man lost the lower part of both his legs, and when he recovered was given a position as signalman. In order to assist him in getting about on his truck he trained a young baboon, who faithfully pushes the truck along.



A Crippled Signalman on the Transvaal Railway and His Baboon Assistant

NEW GAME FOR THE SEASHORE

During the coal strike in England a number of young South Shields miners, seeking new ways of amusing themselves, invented a new game, or, at least, adapted an old one to new conditions. They leveled off a portion of the sand to represent a table and gouged out six or seven cups or holes at one end, each hole having a different value, according to its size. The object of the game is to roll the ball into one of the holes. They called the game sand billiards.

STUDENTS CONSTRUCT OUTFIT FOR EXPERIMENTATION

When the board of school directors of Antis township, Pa., failed to realize the importance of experimental work in agriculture and physics in the high school, because the equipment was too costly, Prof. J. L. Zerhe relied upon the ability and resources of his students. The students were eager to assist. The boys, at recess and noon periods, worked faithfully for two months in the cellar making models,



Experimental Apparatus and Case Made by Students When School Authorities Declined to Purchase Outfit

other equipment, and a case for the experimental apparatus, while the girls prepared the delicate parts and did most of the intricate mounting. The case, when open, has a working space of 30 by 88 in. It contains a sink connected with a reservoir from which the water is raised by a force pump. The equipment is complete, being sufficient to perform all experiments necessary for college-entrance requirements. The cost of the entire outfit did not exceed twenty dollars.

A "PUSHMOBILE" AUTOMOBILE

Two Philadelphia boys have combined a motorcycle engine with a "pushmobile" wagon and made preparations for an endurance run to Atlantic City. The illustration shows the little machine in detail. The own-

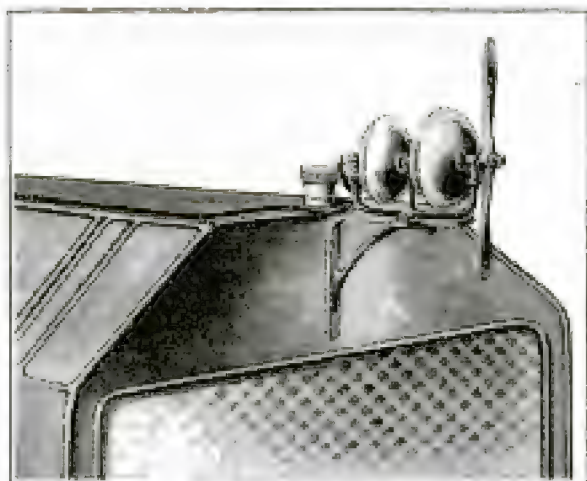


An Interesting Little Motorcycle-Engined Automobile Built by Two Philadelphia Boys

ers claim a speed of 18 miles an hour without much effort on the part of the little motor. The machine is started with a push. One boy sets it going, jumps in, and away they go.

AIR-PROPELLER ALARM FOR AUTOMOBILES

An ingenious propeller-driven alarm bell for automobiles has made its appearance in Paris. The shaft on which the propeller is mounted passes



An Automobile Alarm Bell Rung by an Aerial Propeller Driven by the Resistance It Offers to the Rush of Air Against a Running Car

through the bells and has hammers mounted upon it in such manner as to keep striking as the shaft revolves. The outfit is mounted on an automobile so that, when the chauffeur operates the mechanism which releases the shaft, the propeller is whirled by the resistance it offers to the rush of air. The propeller whirls and the bell rings until the chauffeur operates the mechanism locking the shaft again.

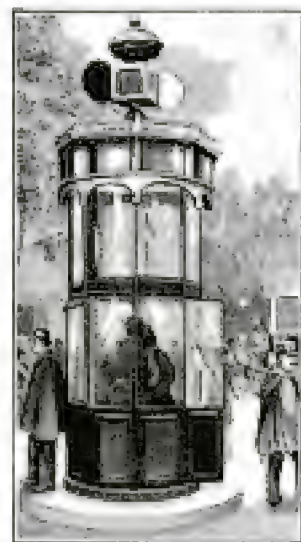
TAXICAB TELEPHONE SYSTEM

In a great many cases, livery companies are unable to use their conveyances to the best advantage, owing to the fact that it is impossible to communicate with the drivers after they have started out with a fare. It quite frequently happens that a driver is sent to some remote part of the city with a fare and then must return empty, while another driver may be sent to a neighboring section for a

fare, and must go out empty. If, however, some means were provided for communicating with the first driver he might not need to return empty, nor would, perhaps, the second driver have to leave the station. This would result in a considerable saving in what is now known as "dead" mileage. For this reason a Pittsburg taxicab company is installing a telephone system, with telephone boxes placed at various points throughout the city, so that the driver of the taxicab may communicate with the company's central office before returning, in order to ascertain whether another fare may be picked up on the way back, thus eliminating the necessity of sending a second machine to the same neighborhood.

STREET-CROSSING KIOSKS FOR POLICEMEN

Street traffic in Paris has been controlled by policemen placed at crossings and provided with whistles, as has become the custom in several of the largest cities in America, but a new signaling system is now being tried out which makes use of an ornamental kiosk, the roof of which is equipped with signal boards. These kiosks, which are placed at the crossings, are glass-covered, and the policeman takes his stand on an elevation inside the structure, from which he has an unobstructed view of the traffic ways. Above the roof, mounted on a shaft, is a cube-shaped, box-like affair, painted white, which is provided with two wing-like extensions. The shaft is turned by a wheel inside the kiosk, and the direction in which the wings face indicates to traffic whether to stop or proceed.



STATE COLLEGE HAS POULTRY HOSPITAL

The Rhode Island Experiment Station has established, at the poultry department of the Rhode Island State College, the most unusual institution for the treatment of the diseases of poultry yet established. It is called the poultry "hospital" and owes its name to the fact that it is primarily an institution for the curing of poultry diseases, just as much as our own hospitals are for the advancement of science in curing the human ailments. This hospital consists of a house of modest appearance, where the patients are treated, and an extensive caged area where the patients may be turned out for exercise and sunshine. This provides for observation of the diseased inmates of the institution, as



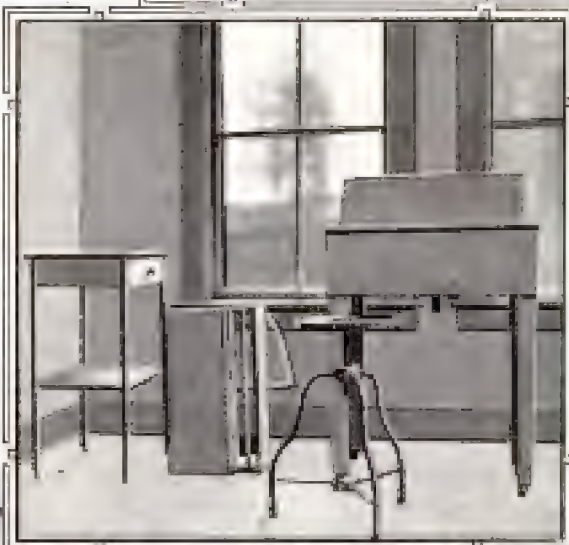
The Poultry "Hospital" at the Rhode Island Experiment Station

On Left—The Operating Room

nearly under normal conditions as possible.

The hospital building is a small one-story building and would scarcely attract the attention any more than the other buildings of the poultry plant.

Yet, it is most interesting in the uses to which it is put. It is divided into four rooms, an office, a laboratory, an operating room, and a "patients' ward," or sanitary-pen room. In the office the head of the biological department of the experiment station, Dr. Philip B. Hadley, conducts the work of the institution. Here the data of the diseased patients are compiled together with the results which may be valuable in combating the diseases investigated. The



The Sanitary-Pen Room of the Poultry Hospital

laboratory is equipped with various kinds of apparatus for the bacteriological investigations, and here is where all the cultures of the diseases investigated are kept and experimented with. Of course, it must be taken into consideration that the work of the institution is more for the prevention and cure of diseases than for the cure of the individual fowls afflicted. Yet the out-of-town patients are rather numerous, for feathered patients are often sent to the hospital to have their ailments diagnosed. In this way the institution is of great value to the state and aids in the suppression of poultry diseases, which would otherwise greatly handicap this most important New England industry. Besides the usual equipment the laboratory is provided with sterilizers, and workbenches offering facilities which are usually found only in the best bacteriological workrooms. The operating room is painted in white enamel and is well lighted for any operations on or inoculations of the feathered patients. As in institutions for humans, most of the furnishings are finished in enamel, and the operating tables are glass or porcelain-topped in

order to minimize the possibility of infection. A special apparatus has been devised to hold the fowls during the operations, and as anesthetics are used, the patients suffer little or no pain. The instruments are kept in a glass case and as carefully sterilized as in the best city hospitals, and during operations the attendants are obliged to wear the same sanitary cloak and observe the same precautions as required in hospitals for human beings.

In that department which might be called the "ward room," are a number of sanitary pens where patients may be kept. This room is finished in concrete and has a concrete floor, making it as nearly antiseptic as possible. Here suspected or innocuous patients are kept while being investigated for different diseases.

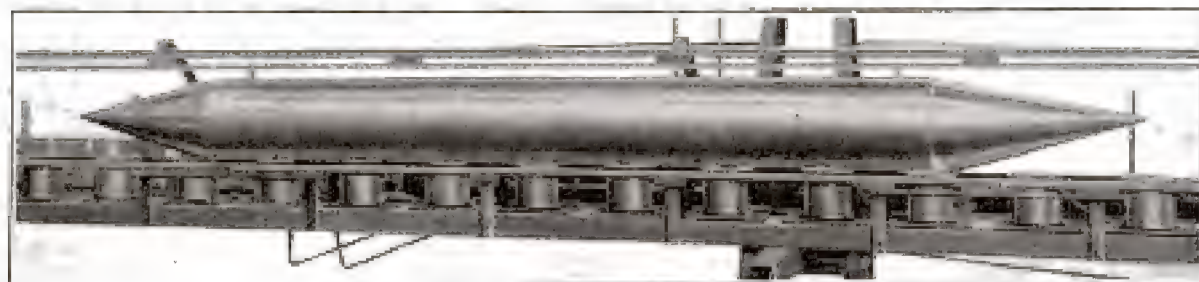
It is believed that much good may accrue from the investigations conducted by this addition to the station, which is at present the only one of its kind in the United States, if not in the world. The department is at present devoting its efforts to the discovery of means by which cholera among poultry may be prevented or cured.

RAILWAY ON WHICH CARS FLOAT ABOVE RAILS

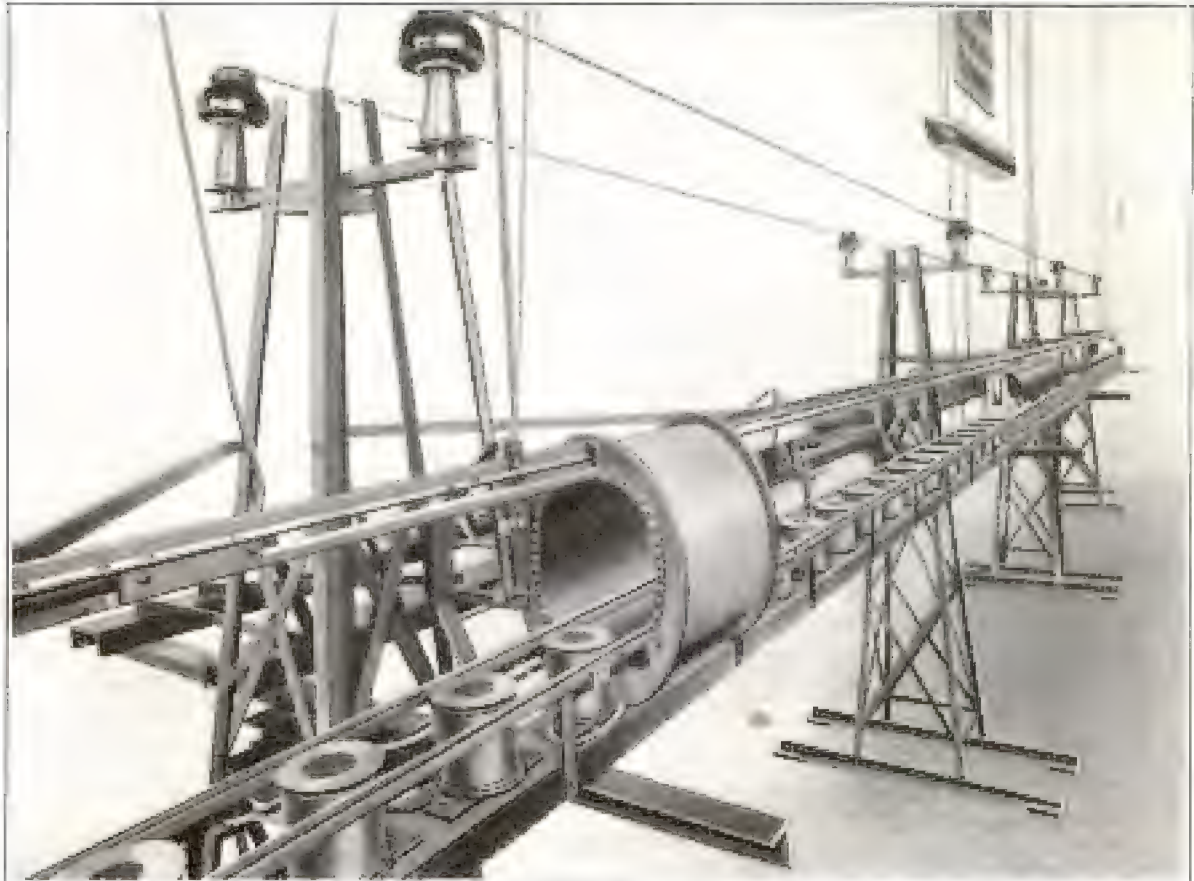
Passenger coaches that float above and between guide rails, with nothing touching except the brushes that control the electrical current, is the dream of a Franco-American inventor of Mount Vernon, New York, who has succeeded in obtaining results with a model apparatus.

In this apparatus, the Foucault or eddy currents induced in a piece of metal placed in an alternating mag-

netic field are utilized to sustain, or, in other words, to make the car float between the guide rails. At frequent intervals upon the model roadbed are placed large electromagnets, so arranged that an alternating current may be passed through them. Only those magnets that are adjacent to the car are energized, the current being controlled by brushes attached to the car and making connection by touching the



One of the Cylindrical Model Cars in Position over the Electromagnets



The Roadway, Showing the Single Line of Electromagnets Directly Above Which the Car Floats and is Drawn Along, and One of the Propelling Solenoids

guide rails. In addition to making the electric connection these brushes also serve as guides to keep the car directly over the electromagnets.

Two model roads have been constructed, one of which has the electromagnets in a line directly in the center of the roadbed, while the other has two rows, running parallel, above and between which the car is sustained. With the first-mentioned type of roadway the large aluminum plate which plays such an important part in the unique invention forms the base of the car, while in the second type the car is provided with two aluminum plates, arranged one on each side of the car, so that each line of electromagnets will have a plate directly above it. When the electromagnets are energized by an alternating current, the aluminum plate, or plates, are in a strong alternating magnetic field, which results in eddy currents being induced in the plate. These eddy currents react upon the magnetic field and produce the



This Illustration Shows the Type in Which a Double Row of Electromagnets is Utilized. The Child is Seated in a Chair Placed on an 18-Foot Model Car, the Whole Being Suspended in the Air by the Action of the Electromagnets. Notice Space between the Tops of the Electromagnets and the Aluminum Plates

force tending to raise and float the car. In addition to the single or double line of electromagnets, solenoids are located at regular intervals, the purpose of which is to provide propulsion for the car. As the iron car approaches, these solenoids become energized and draw it toward them, and the instant the car reaches a neutral position within them, the magnetic effect is reversed, the succeeding solenoids in the line in turn exerting the attractive force.

The inventor of this scheme claims that enormous velocities may be attained as the only friction to overcome is that of the air and the little friction due to the brushes on the rails. He proposes to reduce the friction of the air by making the ends of the car body conical in shape and the main portion cylindrical and very smooth.

The device may appear to practically eliminate mechanical friction, but it is reduced at an enormous cost. The inventor claims he can lift a weight

of about 12 lb. with one kilowatt of power. Neglecting the weight of the car and assuming there are 50 passengers in each car and each weighs 150 lb. we have a total of 7,500 lb. If one kilowatt will lift 12 lb., 625 kilowatts will be required to lift the above passenger load, which neglects the weight of the car, the propelling power required, etc. An electric locomotive that will develop about 2,000 hp. will haul a five-car passenger train up to a speed of at least 70 miles per hour. There would be 3,125 kilowatts or about 4,000 hp. required to lift 250 passengers, or the power required to merely lift the passengers in five cars would be about twice the power required to haul the entire train on an ordinary electric road. The gain in speed seems to be the greatest advantage possessed by the new scheme, but it must be remembered that air friction is not overcome and that this varies as the square of the speed, so it soon becomes exceedingly large.

AUTOMOBILE PUMPS WATER

The owner of a ranch in California recently built a large storage reservoir for irrigation purposes, and adopted a novel scheme for pumping into it. He runs his automobile into position as shown in the illustration, and makes a belt connection with a rotary pump by

means of a large band wheel attached to the driving axle outside one of the rear wheels. The statement is made that water is pumped at the rate of 250 gal. per minute by this arrangement. The storage reservoir will hold 500,000 gal.



An Automobile-Driven Rotary Pump Used to Fill an Irrigation Reservoir on a California Ranch

THE FIRST AMERICAN AERO SHOW

By JAMES R. QUIRK

THE United States may be lagging behind France, England, and Germany in number of aeroplanes in use, and, perhaps, in public interest in aviation, but the first American aeronautic show held recently at the Grand Central Palace, New York, furnished sufficient evidence that real progress in the art of aviation is being worked out in this country by American brains.

Responsibility for our position in the world of aeronautics cannot be placed upon the manufacturers for they but serve the public. Nor can it be blamed upon the public whose enthusiasm has apparently waned in the past year or so. It is but natural in this day of wonderfully fast development in the arts and sciences that the spectacle of man flight should, in a few years, become commonplace to such a degree that the public peers into the sky and views the maneuvers of an aeroplane with no more wonderment than that with which it gazes on an automobilist racing at high speed.

Blame has been placed upon the government for not encouraging aviation to the extent that some of the European countries do, but the gentlemen in Congress who hold the purse strings which even our War and Navy Departments cannot loosen, feel that there is no more reason for the United States joining in the European aviation competition than that we should compete with them in the size of the standing armies.

Sound construction and scientific design, based upon investigation and experience marked the majority of the machines at the American show, and there were but a few of the class which can be termed "freaks." This is an encouraging sign. The day has passed when an inventor can, with any hope of success, impose upon the credulity of the public in announcements of a discovery which will "revolutionize the art of aviation."

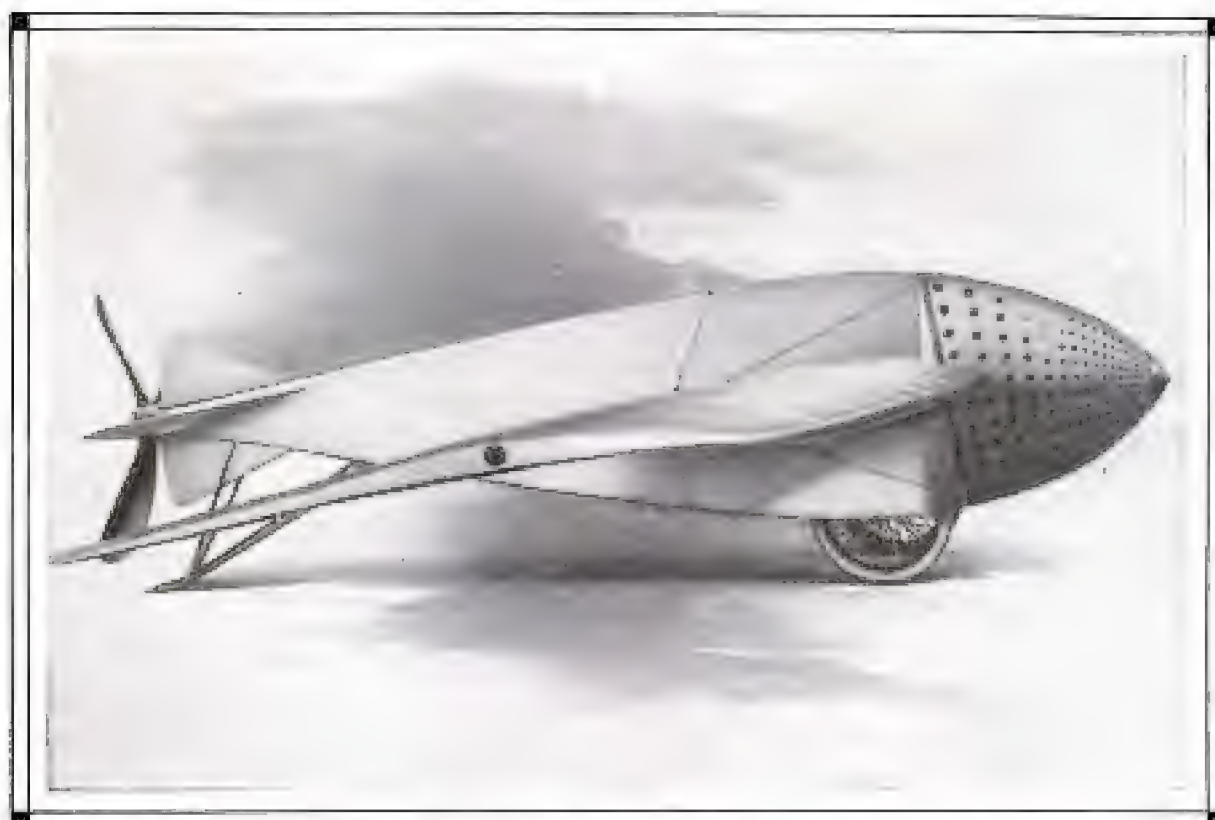
One of the important features of this show, as in the recent London and Paris exhibits, was the increasing

realization of the importance of the streamline form in the design of wings and body. A monoplane, designed and constructed by Edson Gallaudet, utilizes, probably to a greater extent than any other machine ever built, the advantages of this new theory. Many fine flights have already been made with it. Nieuport, whose recent untimely death was a blow to aviation, was one of the first designers to incorporate this theory in the design of his machines, and his monoplanes still hold world's records for speed. It is obvious that a realization of the great advantage of making the air pay back some of the force used in overcoming head resistance is having a potent influence.

Refinement of detail and increasing strength of structure are the only changes visible in the Wright and Curtiss machines. Reference to the illustration of the 1912 Wright biplane will show small, rectangular vertical planes on the front. This is one of the results of the classic Kitty Hawk experiments of last year.

The advent of the hydro-aeroplane, for which America can claim a large share of credit, is, in the opinion of many builders, a thing that may cause aviation to be taken up as a sport much sooner than it otherwise would, and the number of the combination water-and-air craft, was one of the most interesting features of the Central Palace Exhibit. A most interesting design is that credited to Grover C. Loening, a veritable winged boat.

The New York show demonstrated the extent to which the aeroplane has developed as a commercial factor. In addition to the scores of firms which have been organized for the purpose of manufacturing aeroplane engines and parts, a number of the largest concerns in the country are taking up the manufacture of materials and supplies. A few years ago it was considered almost impossible to secure good aviation engines in this country. Now this impression has vanished.



The Bullet, One of the New Machines at the Aeronautic Show. 100-Horsepower Air-Cooled Gasoline Motor is Inclosed in the Blunt Head. A Three-Bladed Propeller is Driven by Shaft



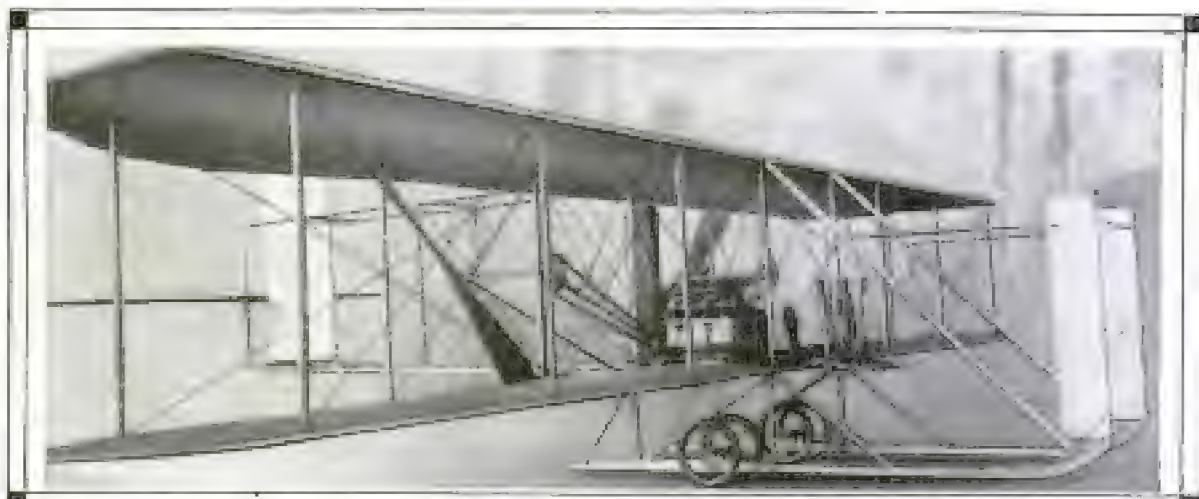
North Carolina Product Which Its Inventor Expects will Carry 7 Passengers and Freight. Although It has Never been Off the Ground to Any Considerable Extent, It is "Guaranteed to Fly"



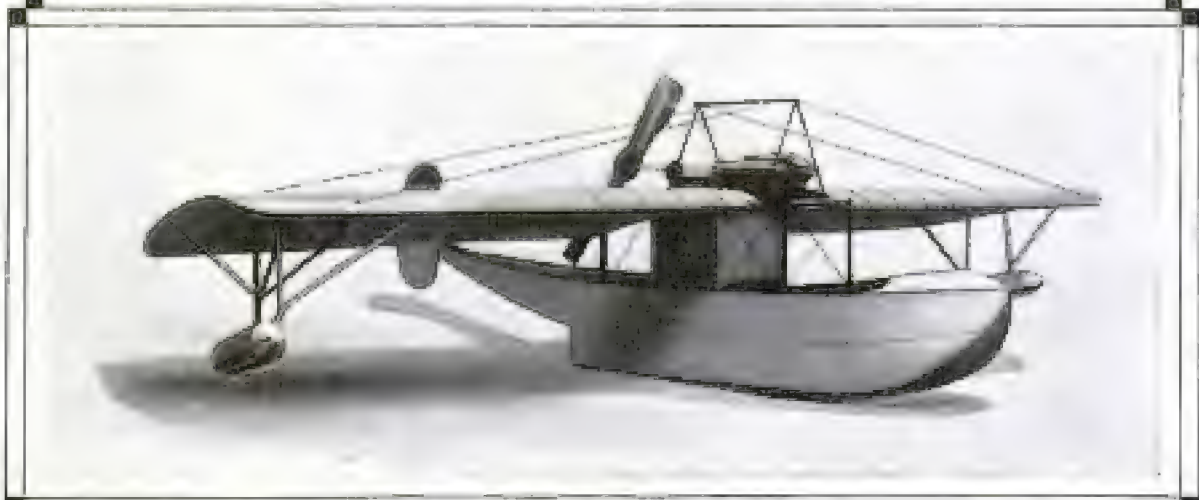
A Multiplane. Built by a Kansas Inventor and Exhibited at Aeronautic Show, Which has Not been Given a Chance to Make Records Yet, as It has Not Flown



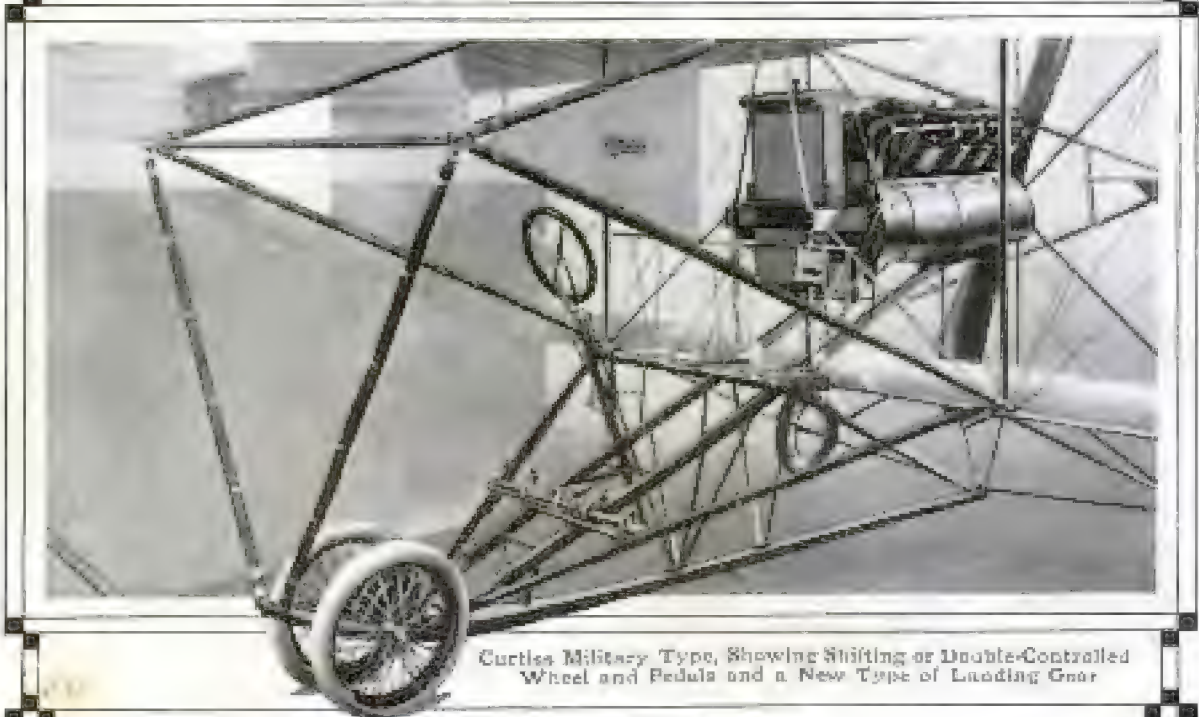
A New Hydro-Aeroplane Provided with Three Seats and Designed for the Purpose of Carrying Passengers



The Improved Wright 1912 Model at the Show; While Several Changes may be Noted, the Machine Clings Closely to the Original Wright Lines



The Queen Aero Boat with a Boat Body Instead of Floats. A Radically New Type Designed by Grover Cleveland Loening

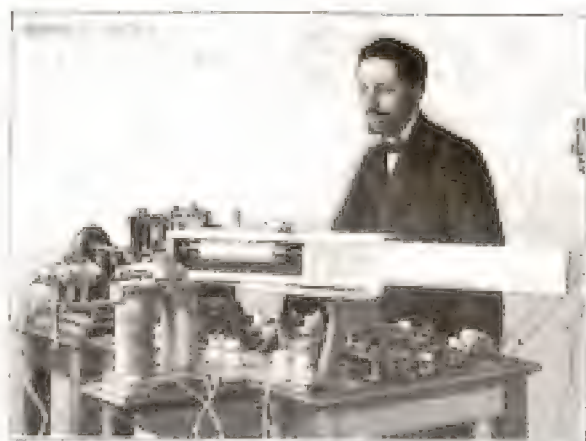


Curtiss Military Type, Showing Shifting or Double-Controlled Wheel and Pedals and a New Type of Landing Gear

TRANSMITTING PICTURES BY WIRE

One of the daily papers of Paris is now publishing half-tone engravings sent by wire from Monte Carlo and the south of France, a distance of about 500 miles, using the apparatus developed by Dr. Korn. The early troubles that prevented practical use of the picture-transmitting device are claimed to have been the great disturbances on the line rather than any fault of the apparatus, but in the present apparatus the transparent film is replaced by a copper film. This is rolled around a cylinder, and, while revolving, a metal point goes all over the image and makes electric contacts corresponding to the whites and blacks. The copper film is prepared entirely by photographic means, and is printed from a negative in such a way as to be covered with fine lines representing the dots of a half-tone. Such lines are thick or thin, according to the parts of the image, and are in insulating gelatine, while the whites are represented by the bare copper. When the point goes over the copper, a current flows; but when the point is passing over the gelatine, the current is interrupted, and this gives impulses on the line.

At the receiving end of the line is a revolving cylinder carrying a photographic film, on which a beam of light, coming through a pinhole, plays. A shutter operated by the line current controls this beam so that it produces

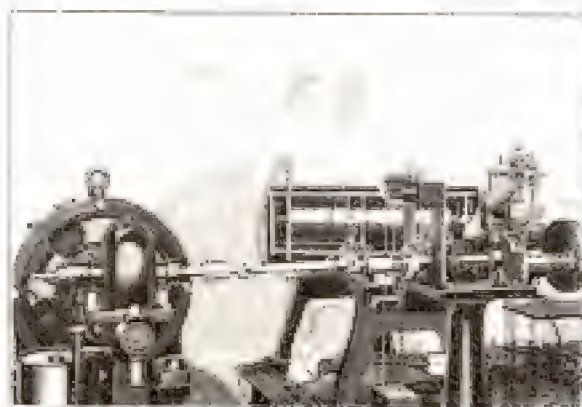


The Receiving End of the Apparatus. Showing the Cylinder with the Photo Film upon It

a picture like the one on the copper film, and this film is then developed and turned over to the photo-engraving rooms for reproduction in the newspaper.



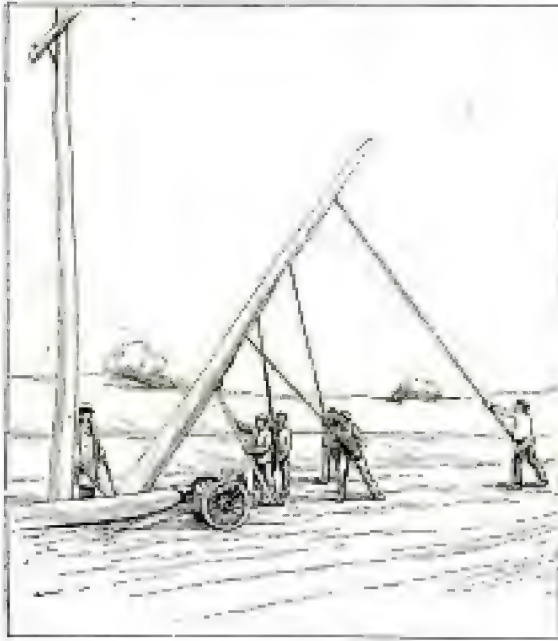
An Aviation Picture Transmitted from Monte Carlo to Paris



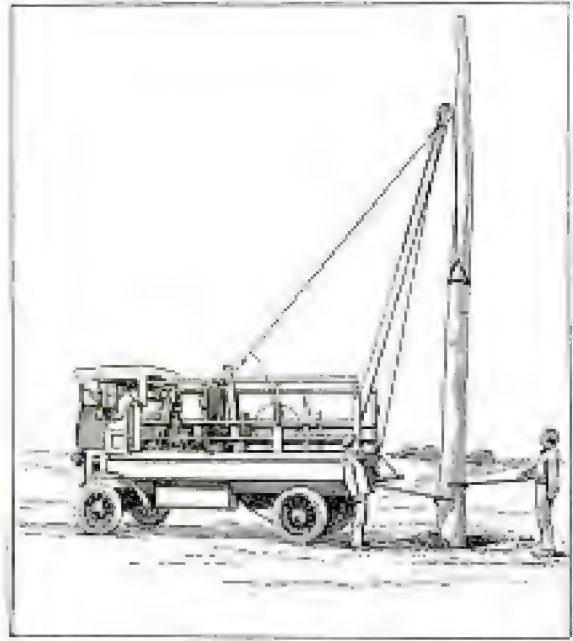
The Transmitting End of the Picture-Sending Apparatus

Quick photographic reporting is thus made possible. During recent aeroplane events in the bay at Monaco, for instance, the operator took photographs in the afternoon, quickly prepared the copper film and placed it in the apparatus, and a few minutes later the reproductions were available for publication in Paris.

A New England manufacturer has just perfected an electric lighting plant for aeroplanes which has a dynamo that weighs 20 lb.



Placing a Telephone Pole in Position by the Old Method



Courtesy the Motor World
Setting a Telephone Pole in Place by Means of a Motor Truck

MOTOR TRUCKS AS POLE ERECTORS

The practicability of the motor truck as an engine for the erection of telephone poles has been clearly demonstrated by the New York Telephone

Company. The accompanying illustrations show the old way of erecting the poles, and the modern method of performing the same task.

FEEDING SUFFRAGETTES THROUGH THE NOSE



Courtesy Graphic, London
Feeding a Suffragette through the Nose; the Plan Adopted by the Prison Authorities to Break the "Hunger Strike"

The accompanying illustration, all external indications to the contrary, does not show a treatment for adenoids, but the forcible feeding through the nose of an English suffragette who refused to partake of food. This remarkable system of feeding is practiced by the English prison authorities, owing to the suffragettes adopting the "hunger strike" as a possible means of gaining their demands. The refusal to eat is not a protest against imprisonment, but an endeavor to obtain the treatment previously accorded to political prisoners.

¶The growth of the automobile business in the last 14 years is shown by the fact that in 1898 there were 25 concerns capitalized at \$2,000,000 making motor cars while in 1912 there are 300 concerns and the capital invested in the business is over \$200,000,000.

POPULAR MECHANICS

IN THE CENTER OF THE WRECK

During a recent meet at Brooklands, Eng., Lieutenant Parke, flying with a passenger in an Avro biplane, met with a bad spill while making a turn. W. H. Fayer, the passenger, is shown in the center of the wreck, viewing the damage.



The Passenger of a Wrecked Aeroplane Surveying the Damage

¶An official agricultural bulletin states that 1,600,000,000 lb. of butter are made in this country annually.

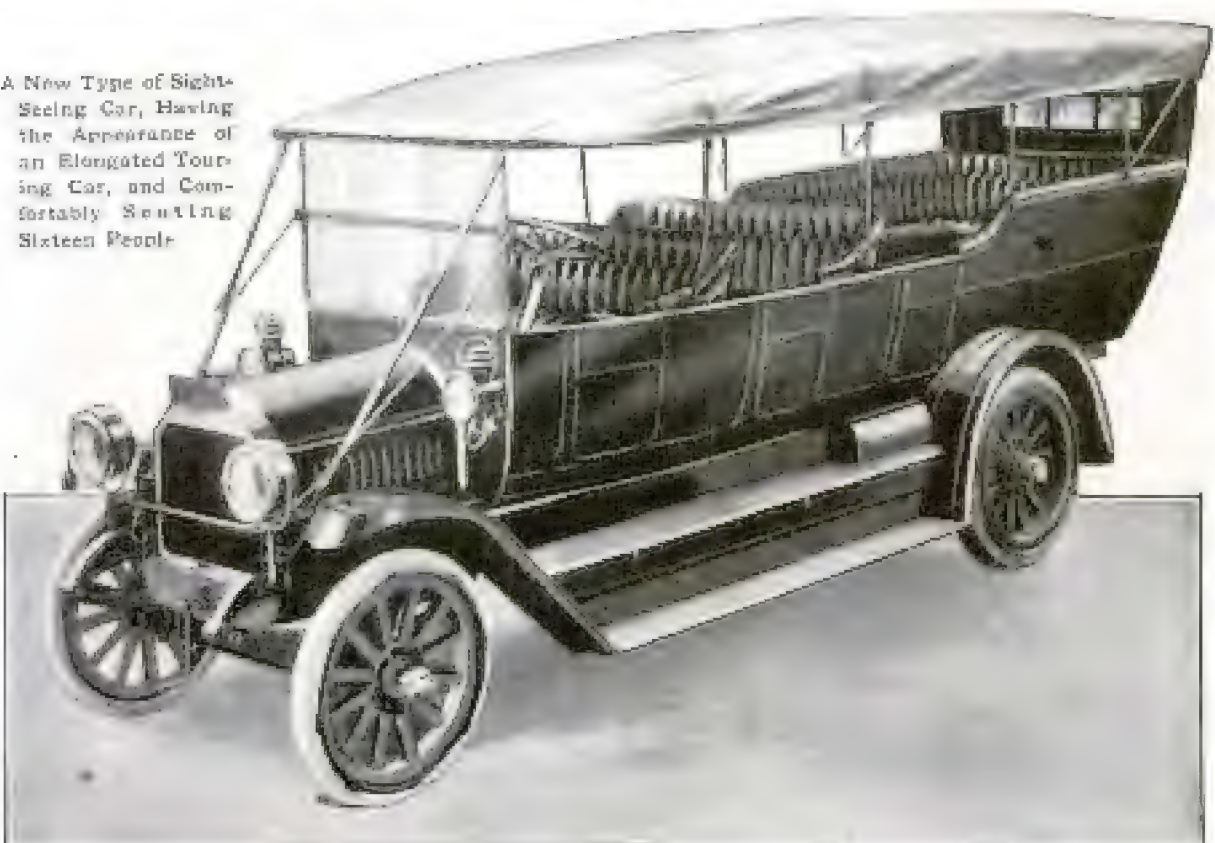
"REFINED" "RUBBER-NECK" MOTORBUS

Efforts are being made toward refining the much abused "rubber-neck" motorbus, a vehicle that has been so joked about and laughed at that many people are ashamed to be seen riding in one. The illustration shows one of the new serviceable, yet good-looking, sight-seeing cars described as "refined." It is built to closely resemble the touring-car type of machine, em-

bodimenting graceful lines. It is said to be the first sight-seeing car of a full fore and side-door design on the market. The seats are so arranged as to comfortably accommodate 16 people.

The first of this type of car finished was shipped to Seattle, where it is being used in conducting parties through the famous Rainier National Park.

A New Type of Sight-Seeing Car, Having the Appearance of an Elongated Touring Car, and Comfortably Seating Sixteen People



POPULAR MECHANICS

BOXING ON HORSEBACK

Boxing on horseback is a new sport novelty which was recently introduced in Germany by a German officer



Boxing on Horseback is a New Sport Novelty Recently Introduced in Germany

ficer who was a pupil of the Anglo-American Boxing Club of Berlin. The men shown in the illustration are Joe Edwards, a former welterweight champion of England, and Bobby Dobbs, at one time a well-known colored fighter in the United States, and now 53 years old. They are both connected with the boxing club in Berlin, which has had much to do with popularizing boxing in Germany.

TRANSPARENT GLASS OF GREAT STRENGTH

A French manufacturer has succeeded in producing a perfectly transparent glass of extraordinary strength, designed especially for use in automobile windshields, for windows in railroad cars, and other purposes where glass may be subjected to sudden shocks. Tests are claimed to show that even wire-reinforced glass has far less resistance than this new glass, the former having been completely shat-

tered by shocks which only succeeded in cracking the latter.

The new glass consists of two layers of glass having a transparent sheet of celluloid between them. The process of manufacture is a rather delicate one, as the two layers of glass have to be attached to either side of the celluloid sheet by means of a special adhesive substance, the whole being then passed through a hydraulic press.

MOVING PICTURES OF THE AURORA BOREALIS

A new camera for photographing the aurora borealis has just been constructed for Professor Carl Stormer, of the Christiania University. The apparatus will be used to measure the relative brightness of the Northern Lights at different periods, and to enable a cinematograph reproduction of the phenomenon to be made afterward. The pictures are to be taken at night, and will consequently require a long exposure, which will extend from two and a half to eight minutes each. It is expected that the results will prove of the greatest scientific value.

A SKYSCRAPER FOR THE DEAD

The accompanying illustration shows an unusual idea in a community mausoleum. It is a proposed skyscraper mausoleum having 10 stories, each of which has a wide balcony. According to the plans it will contain 532 private



Proposed Skyscraper Community Mausoleum



The Members' Stand on the Course of the Johannesburg Turf Club, South Africa

vaults, and a corridor connecting with a large reception room, several comfort rooms and a chapel equipped with an organ and seating 250 persons.

ELECTRIC BABY'S SMILE TWELVE FEET WIDE

The largest single electric sign in the world depicts a baby's face that alternately smiles and sheds tears on the crowds that throng Broadway, New York. The smile is some 12 ft. wide when it reaches its fullest development and each individual tear is 2 ft. long by 10 in. wide. The sign itself is 85 ft. high by 106 ft. wide and contains a total of 9,010 sq. ft. of space. The child's head is 40 ft. high. The sign weighs 80 tons and contains 4,050 electric lights.

It has cost the government \$1,931,208 more to build the battleship "Florida" at a government yard than it cost to build the "Utah" by contract.

JOHANNESBURG RACE COURSE HAS PALATIAL STAND

Horse racing in South Africa is a sport carried on as extensively as in Europe, and several of the race courses compare favorably with those of England. The illustration shows the newly erected members' stand of the Johannesburg Turf Club's course. This stand cost about \$60,000 and is one of the finest in the world devoted to such a purpose.

A FAMOUS WATER HOLE IN CALIFORNIA

Seventeen Palms Spring is one of the famous water holes of the Southern California desert, the vivifying water of which has brought renewed life and hope to thousands of desert travelers, while it has been likewise the un-reached goal of scores more whose bones have bleached the old overland trails—those who failed to get through.

The spring would be considered but a poor enough watering place by those



Seventeen Palms Spring, Southern California, Which Has Been a Welcome Sight to Many a Tired and Thirsty Pioneer

of us who know only the east with its multitude of water supplies, and who would deem it an almost unbearable hardship to travel afoot for a single day without water. But to those who have gone two days and nights, or possibly three, with no water and under a brazen sun and a mercury at 120 or

worse in the shade, the Seventeen Palms Spring is life itself. The palms which have given the place its name, seem to eke out but a precarious existence, and there are no longer 17 of them, some having died. Yet, sickly as they appear, they are a welcome sight to man and beast who travel this route.

PORTE-COCHERE AUTO GARAGE

An ingenious idea in automobile garages has been worked out by Dr. H. Leslie Moore, of Dallas, Texas. His garage is attached to the side of the house in the position that a porte-

cochere would occupy if provided, and in appearance it very much resembles the latter. The inside door of the garage opens into a small hall leading into the rest of the house, and the doctor may step from it directly into his machine.



The Porte-Cochere Garage of a Dallas, Texas, Physician

SIGNAL DISKS PLANNED TO STOP JOY-RIDING

The assistant manager of a New York detective agency has recently taken out a patent on a device intended to check joy-riding. It consists of a copper plate, which may be fastened to any part of the car where it will be clearly visible to the police. On this plate is a hinged metal disk, the hinge being bolted to the middle of the plate

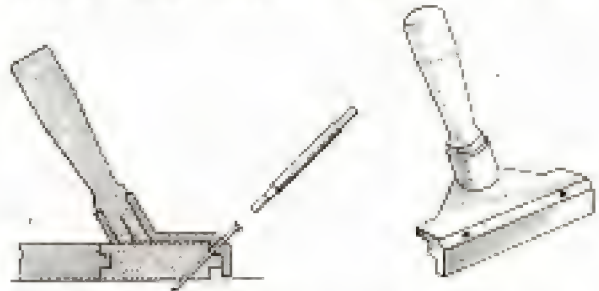
in a substantial manner. When the owner of an automobile or his authorized agent is in charge of the car, the disk is turned down and locked in place, and in this position displays a black enameled circle. When the owner is through with the car and does not wish anyone to use it, he unlocks the padlock, turns up the disk until it lies flatly against the plate, and relocks it, the plate showing two bright red spots when in this position. The plan is to notify the police or others engaged in preserving the peace that there is something wrong when a car appears on the street with two red disks showing.

TENTED "CITY" ON HOTEL ROOF

The management of one of the big hotels at San Diego, Cal., has solved the problem of hotel congestion and satisfied the outdoor-air enthusiasts by erecting 22 large tents on the roof. Each tent contains a bed, washstand, dresser, wardrobe, and a chair. Many of the guests prefer the tents to the most luxurious rooms of the hotel.

COMBINED FLOOR SET, NAIL SET AND SHIELD

An ingenious device, designed to facilitate the laying of hardwood floors, was recently patented by an



A Device Which Materially Aids in the Laying of Floors

inventor of Lawrence, Kansas. It makes possible an accurate set of the boards, an accurate driving of the nails at the correct angle, and also protects the floor from being bruised during the operation of driving the nails through the holes.

¶The cost of stopping an ordinary train of passenger cars that is moving at the rate of 50 miles an hour is said to be \$1, the time lost being estimated at 145 seconds.



Twenty-Two Sleeping Tents on the Roof of One of the Big Hotels in San Diego, Cal.

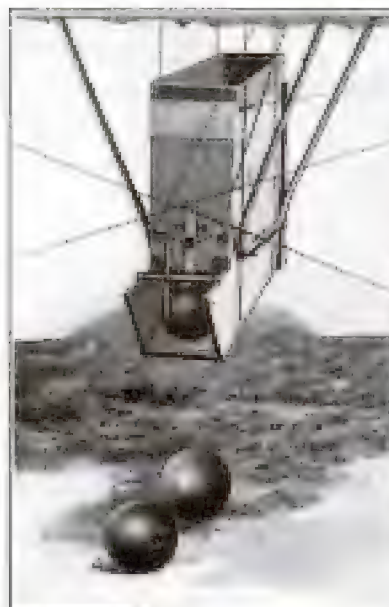


Lieutenant Bousquet in His Biplane. The Officer Who Drops Bombs is Protected by a Windshield, and on Each Side of Him are Ammunition Boxes

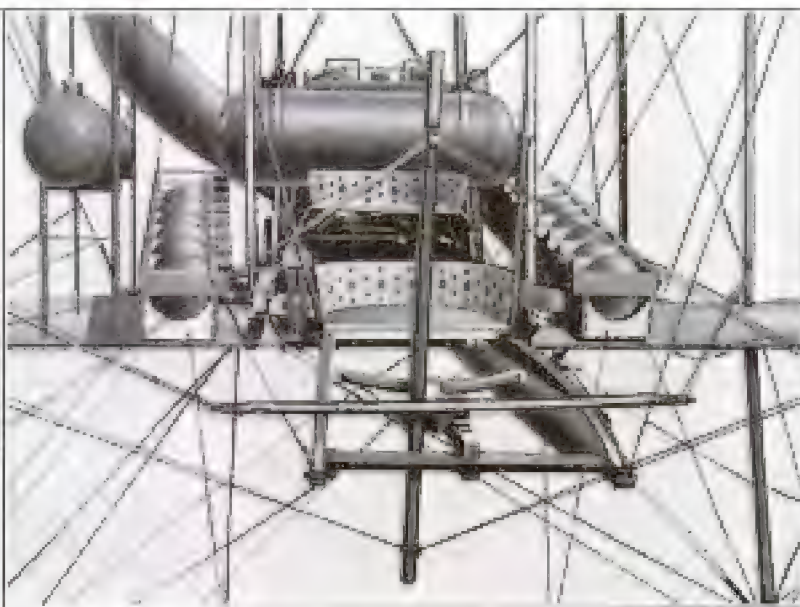
FRENCH WAR AEROPLANE

Aeroplane tests are being conducted by the French army on the historic drill ground at Chalons in an endeavor to determine to what extent aeroplanes can be used as flying artillery.

The accompanying illustrations show an interesting aerial bomb-dropping equipment which was designed by Lieutenant Bousquet of the French army.



Bomb-Throwing Apparatus, Showing Two Bombs Just Discharged



A Close View of the Seating Arrangement, Showing the Cases Containing the Bombs Arranged along Both Sides

THE WESTERNIZATION OF THE HOLY LAND

By H. J. SHEPSTONE

VERY rapidly, and with so little publicity that the rest of the world scarcely recognizes it, the westernization of Palestine has been going on ever since the triumph of the Young Turkish party over Abdul Hamid, the late Sultan, some three years ago. In political, educational, and particularly in economic reforms, there has been a great deal of progress. Important railroad and transportation concessions have been granted, while Jerusalem, Jericho, and Palestine's newest city, Beersheba, have been given a much needed water supply.

Until quite recently the Holy City has been entirely dependent for its water upon the rainfall. Now it is brought to the city from Solomon's old pools, to the south of Bethlehem, by means of specially laid pipes. Thus the ancient cisterns, built to supply Jerusalem with water in Solomon's time, have been repaired and made to supply the Jerusalem of today with pure water. Then, what is believed to be the well used by Abraham at Beersheba now supplies that town with water by means of a modern motor pump, while Jericho obtains fresh water from Elisba's Fountain by means of specially installed pumps and pipes.

Both Damascus and Beirut have also recently had their water supplies greatly improved, and now boast of their electric tramway services. Damascus was the first city in bible lands to have electric trams and electric light. This is remarkable when we remember that it is the oldest city in the world, having been a place of great importance in the days of Abraham. In the near future, however, Jerusalem will undoubtedly possess electric trams, and representatives of an important American syndicate are now in the Holy City submitting plans for equipping it with an efficient tramway service as well as with electric light.

Indeed, in every department of com-

mercial enterprise and activity, modern methods are being rapidly brought into vogue. On the rich plains of Sharon and also on the tablelands between Jaffa and Jerusalem, steam-driven threshing machines and modern harvesters may be seen, taking the place of the primitive threshing floors. Then, all over the country, particularly in the orange groves, the primitive way of raising water for irrigation and other purposes is being superseded by pumps driven by kerosene motors.

Then, in Jerusalem itself much has been done in widening some of the narrower thoroughfares, particularly in the business quarters of the town. The city is now better drained and its streets better kept. Two modern water-carts were recently imported and are now being used and the municipality has been supplied with a modern steam fire-extinguishing pump. It was but recently also that the Turkish authorities granted a concession to several American and English companies for the construction and exclusive operation of telephones both in the Turkish capital and also in Jerusalem, while an English company is about to furnish the Jerusalem police with bicycles. The very latest appliances may be detected in the building operations that are now going on and reinforced concrete is being used in some of the more important edifices.

On that historic sheet of water, the Dead Sea, there is now a motorboat, the only self-propelled craft at present on Palestine waters. For permission to run this craft its owner pays the government a monthly rental of \$50. The authorities in Constantinople are now considering applications for permission to place similar craft upon the Sea of Galilee and the River Jordan.

Perhaps it is in transportation facilities that the development is most marked. One has only to add that when the Turkish parliament met in



The Opening of Modern Waterworks in Jerusalem was Attended with Elaborate Ceremonies Participated in by All Classes of the City's People



Power-Driven Threshing Machines and Harvesting Apparatus are Common Sight on the Plains of Sharon, between Jaffa and Jerusalem



Modern Watering Cart Sprinkling Streets of Jerusalem



Trolley Cars Now Traverse Streets of Damascus



Motorboat "Sheikh Jalal," which Carries Passengers and Freight to Ports on the Dead Sea



One of the Four Pathway Lines in the Holy Land



Up-to-Date Reinforced Concrete Construction has been Adopted in Jerusalem

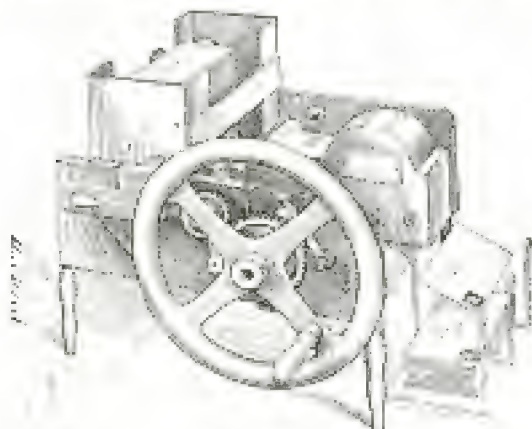
the spring, there were submitted to it plans for the construction of no fewer than 1,500 miles of railroad, with mineral and oil rights in the Asiatic dominions of the Sultan, to show the rapid development now going on in this part of the world. The lines of the Hedjaz Railroad are to be carried with all speed across the 285 miles of desert between Medina and Mecca. Starting from Damascus, this line runs almost due south through wild and sterile country for more than 820 miles to Medina, the burial place of Mohammed. It is principally used for carrying Mohammedan pilgrims. At many of its more important stations one can now send telegrams in any European language to all parts of the world. Until quite recently they had to be written in either the Turkish or the Arabic language.

This, of course, is by no means the only railroad in Palestine. The first to be opened was that which connects the seaport of Jaffa with Jerusalem. Then followed one from Beirut, on the coast, to Damascus, and more recently,

the line from Haifa, also on the coast, round the southern end of the Sea of Galilee to Damascus. Of the lines yet to be built in Asiatic Turkey, one will extend from Samsoun, on the Black Sea, in a southeasterly direction to a point near the Persian border. Another will start from some port on the Mediterranean, not yet determined, and stretch in a northeasterly direction to Lake Van, crossing the other line. When the famous Bagdad Railroad has progressed another 200 miles, with the Bosphorus spanned by a bridge, and the Hedjaz enterprise completed, Mecca will be in direct railroad communication with Constantinople, and also with the great centers of Europe. When the other lines now projected are completed, Persia will be connected with the Mediterranean Sea, and Nineveh, the ancient capital of Sennacherib, will be a halfway station between a reformed kingdom of the Shah and a Palestine which has been quickened to modern life by steel rails, telegraphs, telephones and western business methods.

LETTER SEALING AND STAMPING MACHINE

This machine, which is but little larger than a standard typewriter and weighs only 50 lb., is claimed to seal,



A Machine That Will Seal, Stamp and Count Several Thousand Letters per Hour

stamp and count as many as 7,000 letters per hour, handling envelopes of various size and thickness without ad-

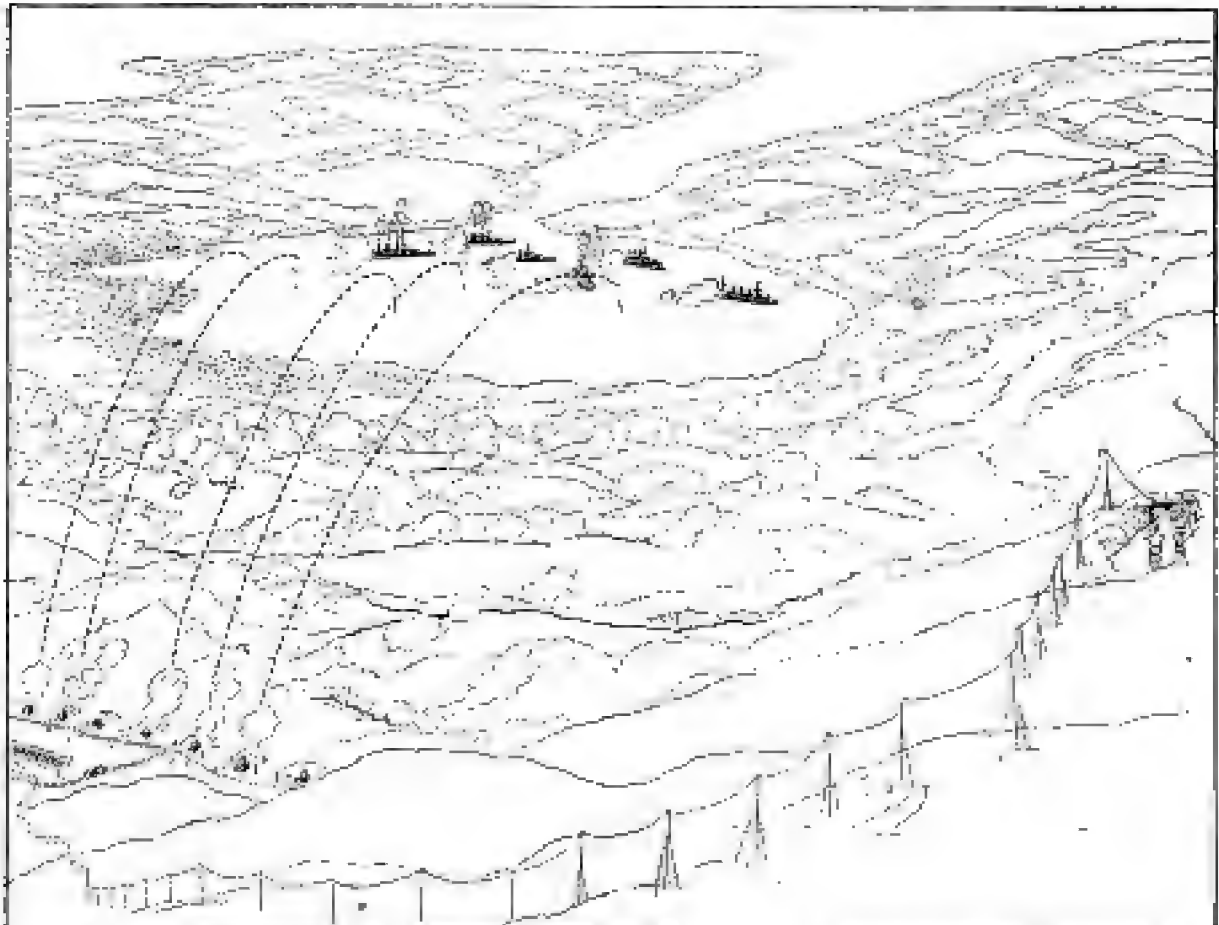
justment. The letters are inserted, flaps down, in the box on the front of the machine, and a reciprocating feeding blade, from which the moisture for the envelope flap is taken, moves forward between the flap and the envelope proper, carrying the envelope forward to the soft-rubber sealing rolls. During this operation the stamp is fed forward from the roll of stamps in the fore part of the machine, where the stamp is moistened, then cut off and carried to the moving envelope, where the process of stamp application and letter sealing is automatically completed. The machine illustrated is driven by a hand wheel, but power may be substituted.

When the Panama Canal is finished, it will be the greatest coaling station in the world, it being estimated that the coal and oil traffic alone should amount to \$10,000,000 annually.

COSTLIEST TELEPHONE LINE EVER BUILT

The costliest mile of telephone line ever erected is the temporary line which the Japanese army experts constructed from the foot to the top of 203-Meter Hill, just outside of Port Arthur, during the siege in the Russo-Japanese war. It might also be asserted that few lines represented the expenditure of so much energy, resourcefulness and courage, to say nothing of human life,

four or five miles distant from their main objective, the town and fleet. Between them and their targets interposed this chain of hills, tall and almost impregnable. Hence, using the guns was purely guesswork, something like throwing a stone at a man on the other side of a house. The gunners could not get the slightest idea as to where their shells struck.



Topographical Map of Port Arthur and Its Defenses, Showing Route of the Costliest Mile of Telephone Line Ever Constructed. Big Japanese Guns in Lower Left-Hand Corner, and Telephone Station at Right; Russian Fleet in the Distance

or were used for so short a space of time with such tremendous results.

Early in the siege of Port Arthur the Japanese, finding field guns wholly inadequate to reach the town and harbor, set up half a dozen or more great 10-in. guns, "Osaka babies" they called them. These were placed as near as possible to the main defenses of the town which were located along a semicircular chain of hills, surrounding the harbor. The guns were some

Far over to the Japanese right, near the end of the Russian hill forts, was the loftiest point in the district, 203-Meter Hill. From its summit one could look squarely down into the town and harbor of Port Arthur. It was strongly protected by fortifications and also flanked by other Russian forts.

To gain possession of the summit of that hill General Nogi addressed all his skill and force. Its sloping sides

were lined with intrenchments protecting thousands of Russian riflemen, while from either side the neighboring forts could pour shot and shell into any attacking force. For a few days the Japanese assaults were simply slaughters. At length Nogi obtained a foothold at the base, and slowly, day by day and by night as well, he worked his way up while 30,000 Russians and hundreds of guns poured their fire into him. Finally he gained the summit, built a small bomb-proof and left there—two men and a telephone!

That was all, but it was all he needed. Thousands of Japanese soldiers protected these two from Russian attacks, which continued ceaselessly, for those two men with the telephone could do more harm than all the rest of the Japanese army. Their telephone line ran down the hill and, thence, to the great "Osaka babies." At a signal from the man at the phone, great shells were flung over the hills toward Port Arthur. The men on the

hill watched their landing through field glasses; then they telephoned that gun No. 1 had struck too far right or left of some battleship or arsenal. Thus corrected, the next shots dropped closer; the telephone man again corrected the gunner. And so, through that single wire, the man at the phone directed the fire of the great guns until the Russian fleet, batteries, and arsenals, powerless against such an enemy, were abandoned.

The fate of Port Arthur was decided by the man at the phone. But it had cost dearly. What the Russian loss was is not exactly known, but the Japanese lost 10,000 killed and wounded, expended hundreds of thousands of rounds of ammunition, besides the time and energy of a great army for a period of more than a fortnight, in running that last mile of wire to the top of the hill. It is therefore safe to say that the cost of no other mile of wire ever even approached such a tremendous sum. But, from the Japanese point of view, it was worth it.

AUTOMOBILE USED TO LIGHT A TRAIN

One of the special trains used as a hotel during the automobile races recently held in Savannah, Ga., developed troubles in its electric generating mechanism, thus interfering with its lighting system. The difficulty was remedied by renting an electric automobile and connecting its batteries

by this method during the time the train was side-tracked at the race course.

VIOLINS WITHSTAND HEAVY STRAINS

Few violinists give any thought to the amount of pressure exerted on the top of a violin by the bridge, and the amount of tension of violin strings, yet both are very considerable. The total pressure on the bridge, and thus on the top of the violin, is, according to the Violinist, nearly 25 lb., and it takes a pulling force at the pegs of nearly 64 lb. to bring the strings to "international" pitch. The downward pressure on the E-string side of the bridge is a trifle over 11 lb., and that of the G-string side, nearly 10 lb. This tension,



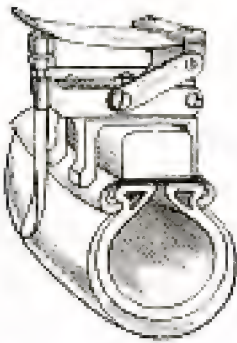
An Electric Automobile Furnishing Current to Light a Special Train, Side-Tracked at the Savannah Automobile Races

with the lighting circuit of the train by cable. All lights were furnished

or pull on the string, is supported by four small pegs of wood relying on friction for their sticking qualities. This friction hold must exceed an average of 15 lb. for each peg, if the string is to hold. Yet the violin is considered to be the most delicate of musical instruments.

DEFLATED-TIRE ALARM FOR AUTOMOBILES

A French device that informs the driver of an automobile when a tire



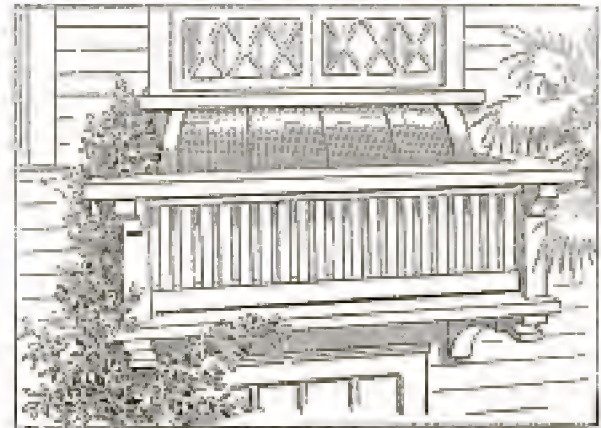
becomes deflated beyond a certain degree, is shown in operative position in the accompanying drawing. It is attached to the wheel rim, the vertical member being adjustable to any desired depth. When

a tire becomes deflated to such an extent that this vertical member touches the ground, it strikes against a piece of spring steel, causing this to vibrate violently and produce a strident alarm sound once in each revolution of the wheel.

A NEW OUTDOOR-INDOOR BED

Beginning with the bungalow, Southern California home builders have become noted for the innovations they have made in dwelling-house architecture and built-in interior ef-

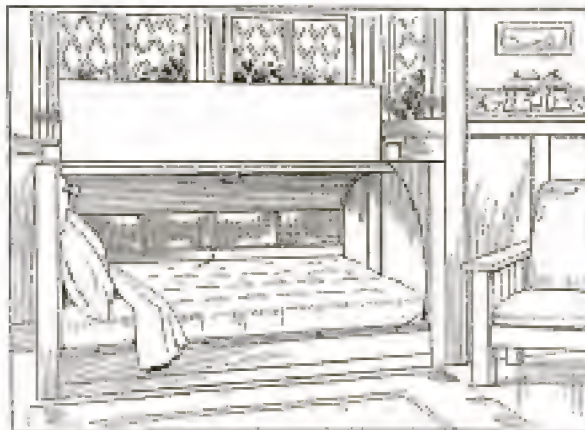
fects. The very latest of the latter is a bed which, at the will of the occupant, may be either in the room or



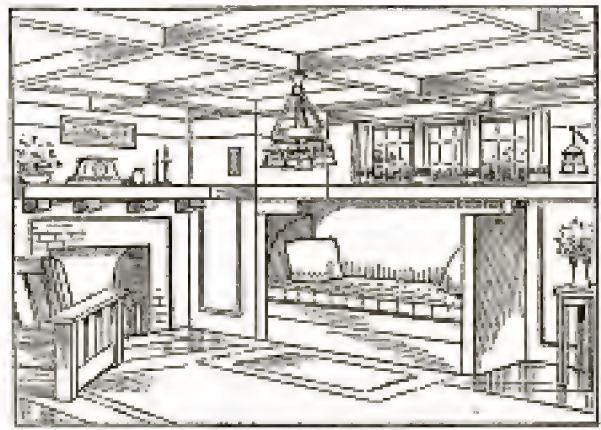
The Bed Inclosure, Appearing from the Exterior as a Balcony

outside in the open air, yet, paradoxical as it may seem, remain in the same place. This is accomplished by building the bed inclosure in the outer wall of the house or apartment, the inclosure, when the bed is closed, appearing as a davenport, inside the room, and from the exterior as a balcony. The inclosure projects, outside, from 30 to 36 in. from the wall.

Over the bed is a movable half-dome which may be lowered either over the outside end of the bed, effectually shutting off the outer air, rain or dust; or over the inside part, thus placing the sleeper entirely outside the room in the open air. From a hygienic standpoint, this new bed far surpasses the outdoor sleeping-porch bed, for the reason that when retiring to his sleeping chamber, the occupant takes with



The Movable Half-Dome, Which may be Lowered Over the Outer Side of the Bed, or Over the Inner Side, the Latter Arrangement Placing the Sleeper Entirely Outside the Room. The Appearance Inside is That of a Davenport



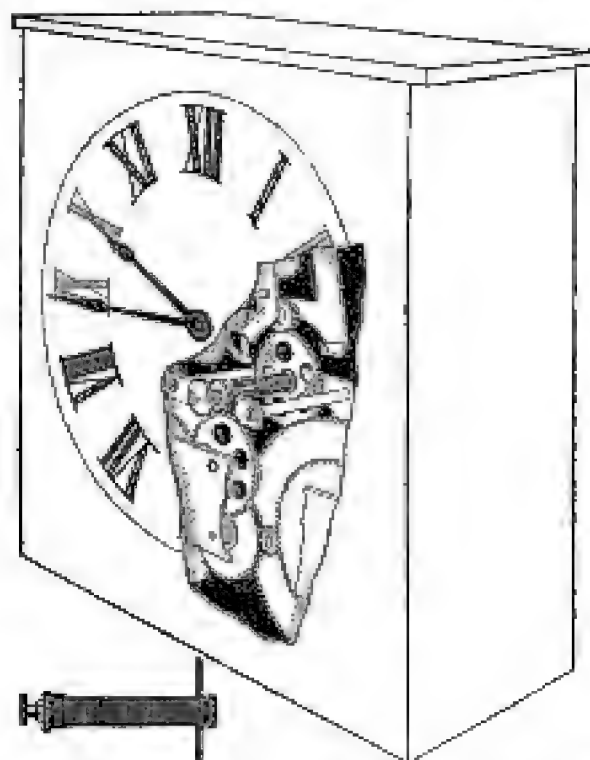
him a volume of warm air from the room and thus experiences a gradual change of temperature, instead of the sudden transition from a warm room to a cold porch. In case of storm, the dome can be swung over completely to shut out the rain.

Another advantage of this bed is the saving in space, for the inside projection is utilized as a davenport and, as compared with the sleeping porch, there is a large saving in space outside.

The bed may be either installed in a house already completed, or built in while it is being erected.

MAKING A CLOCK RUN A YEAR

The attachment of a small device recently perfected by a Chicago clock expert will, if it accomplishes what is claimed for it, turn an ordinary eight-day clock of standard make into a clock that will run more than a year



The Clock That Runs a Full Year without Stopping. Showing, Just under the Hands of the Clock Face, the Governor which Does the Work. A Side View of the Governor is Below.

without rewinding. Not only is it claimed that the clock will run a year, but it is also stated that its power plant—its springs and the wheels that

transmit their action to the works of the clock—can be used to operate other mechanical devices that are made to run with clockworks. The device that accomplishes all this is called a "governor," and its use converts the clock into what is termed a "differential clock," because it permits the operation of other pieces of mechanism besides the time-measuring machinery.

The governor is a small steel shaft on which is mounted a helical spring. The shaft is so constructed that a portion of it can be expanded so that the amount of power from the helical spring can be regulated, and no more supplied to the mechanism actuating the time-measuring part of the clock than is absolutely necessary. The clock springs are so adjusted to the governor that when the shaft has been expanded and all the power in the unexpanded section has been used, these springs automatically turn the helical spring to give it additional power. In this manner the clock springs proper are called into action for time measuring only when the helical spring exhausts itself, and, therefore, will keep the clock going for a much longer period than without such a device as the governor. A clock equipped with a governor has actually run 418 days without rewinding. The tension of the helical spring is adjusted with a setscrew and it can be adapted practically to all standard makes of clocks.

HIGH-EFFICIENCY WATER WHEELS

The performance of three low-head water wheels designed by Prof. S. J. Zowski, of the University of Michigan, far surpasses the highest power of any other wheels given a recorded test. The wheel which previously held the record, was 28 in. in diameter, and, in the Holyoke testing flume, its best efficiency was 86.2 per cent, at 52.8 revolutions per minute, and 2.05 hp., under 1-ft. head.

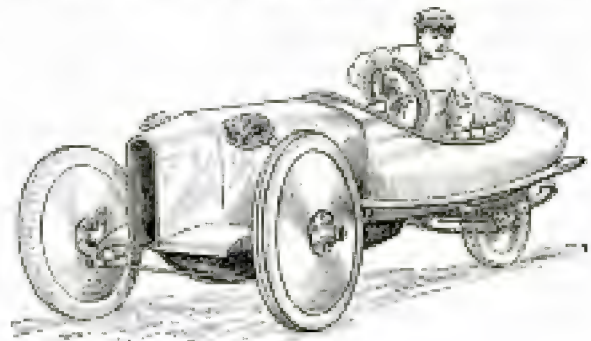
The wheels designed by Professor Zowski, all of which were 30 in. in

diameter, were tested with the same draft tube and test arrangements, only the runner and guide vanes being changed. The first of these wheels showed a maximum efficiency of 87.2 per cent, at 49 revolutions per minute, and 3.18 hp., under 1-ft. head. The second wheel showed a maximum efficiency of 88.75 per cent, at 48 revolutions per minute, and 2.65 hp., under 1-ft. head, while the third wheel, designed to increase the power at maximum efficiency, showed a maximum efficiency of 89.2 per cent, at 50 revolutions per minute, and 3.26 hp., under 1-ft. head.

Chewing gum is said to be a peculiarly American habit, merchants having discovered that there is no sale for gum in foreign communities where there are no American residents or tourists.

A RACING DUOCAR

Races for duocars, the name given to the little three-wheeled machines



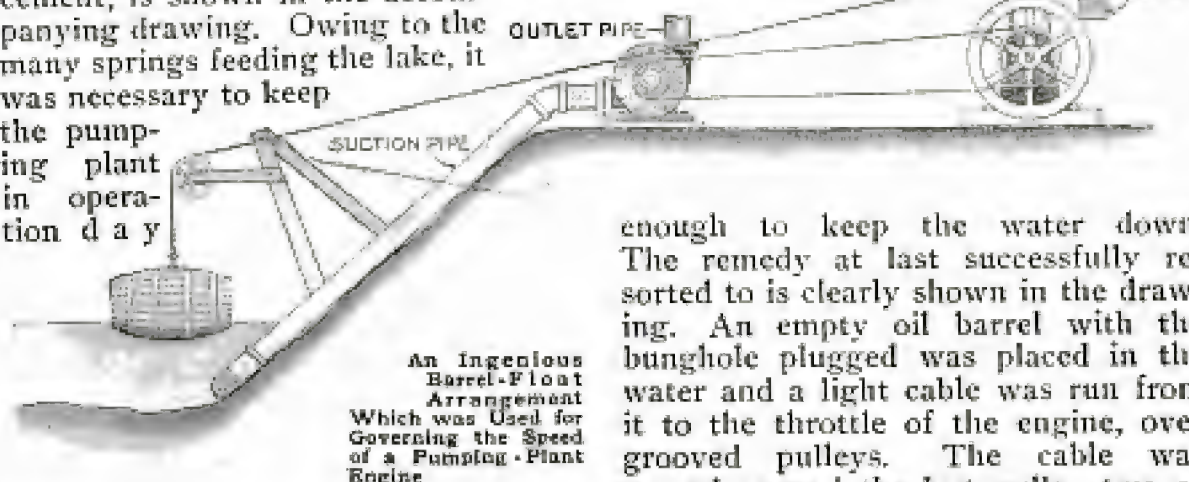
A Type of Racing Duocar

which form the connecting link between the motorcycle and the automobile, were recently held at the Brooklands motor course in England. An idea of how these little racing cars are constructed may be gained from the accompanying illustration.

BARREL FLOAT AS ENGINE CONTROL

An ingenious method of automatically controlling the speed of a 20-hp. slide-valve steam engine, used in keeping a small spring-fed lake clear of water, so that the marl could be shoveled from its bottom for use in making cement, is shown in the accompanying drawing. Owing to the many springs feeding the lake, it was necessary to keep the pumping plant in operation day

and night, but, as the amount of water supplied by the springs varied greatly, and as the engine had no governors, much trouble was experienced in regulating the engine's speed. Sometimes the rotary pump would drain all the



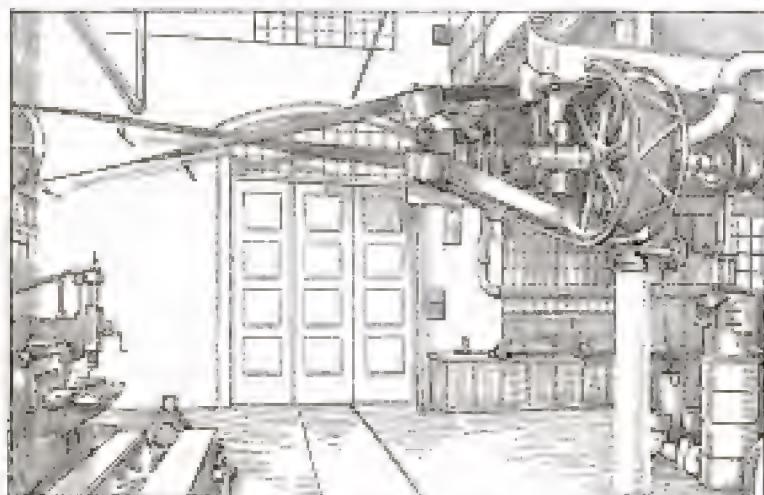
An Ingenious Barrel-Float Arrangement Which was Used for Governing the Speed of a Pumping-Plant Engine

and night, but, as the amount of water supplied by the springs varied greatly, and as the engine had no governors, much trouble was experienced in regulating the engine's speed. Sometimes the rotary pump would drain all the

water out of the hole and lose its priming, thus causing the engine to race, and at other times the engine would not be running fast enough to keep the water down. The remedy at last successfully resorted to is clearly shown in the drawing. An empty oil barrel with the bung hole plugged was placed in the water and a light cable was run from it to the throttle of the engine, over grooved pulleys. The cable was wound around the last pulley two or three times and a weight was attached to the loose end, to counterbalance the barrel. The device is said to have worked perfectly, the engine speeding up when the water level rose and slowing down when it fell.

BELT TRANSMISSION AROUND A CORNER

A belt transmission that turns a corner is shown in the accompanying illustration. It connects up two shafts which are set a considerable distance



Interesting Belt Transmission between Two Shafts Set at Almost Right Angles and at Different Elevations from the Floor

apart at different elevations from the floor and at practically right angles to each other. It is claimed that a minimum obstruction of space and the free use of the doorway are thus obtained. The lattice work guard around one of the pulleys and the iron brackets driven into the wall near the other pulley are safety provisions designed to catch the belt should it break.

LOSS OF QUEUES CAUSES DEMAND FOR HATS

The wholesale cutting off of queues, which was a consequence of the revolution in China, cooled the heads, at least in a literal sense, of the Chinese to such a degree that there arose an enormous and unprecedented demand for head covering. The native hat industry, being but little developed, was unable to keep up with the demand made by the shears, and Japan, where the industry is flourishing, was flooded with orders. The Japanese factories have been working night and day for months to fill the unexpected need of the new republicans.

GREAT BRITAIN ORGANIZES AIR NAVY

Great Britain, at last realizing that an efficient navy of the air is no less urgent in her case than in that of the other great military and naval powers of Europe, has commenced the organization of an aeronautic service on comprehensive lines. With the issuing of a "White-Paper" from the War Office recently, the "Royal Flying Corps" takes its place definitely as a fighting arm. Not only is a reserve of flying men, which may be drawn on in an emergency, to be provided, but a force of "regulars" is to be organized. Aerodromes, landing places and sheds are to be constructed at intervals throughout the country, converting England into one vast airway system with fixed stations; under the auspices of the government, a school is to be opened on Salisbury Plain, and 37 aeroplanes have already been ordered.

The air navy, as initially planned, will consist of 364 men, seven air squadrons, each squadron comprising 12 aeroplanes; one airship squadron, and one kite squadron.

The course of the Salisbury Plain School will include progressive instruction in the art of flying; instruction in the general principles of mechanics and the construction of engines and aeroplanes; instruction in meteorology; training in observation from the air; instruction in navigation and flying by compass; training in cross-country flights; photography from aeroplanes; signaling by all methods, and instruction in types of warships of all nations.

A frank admission of inferiority is included in the government's announcement of the organization of the air corps. "The government has been impressed by the state of aerial navigation in this country, compared with the progress made by other great naval

and military powers. The efficiency of the aeroplane for purposes of military reconnoissance has been proved both in foreign maneuvers and in actual warfare in Tripoli."

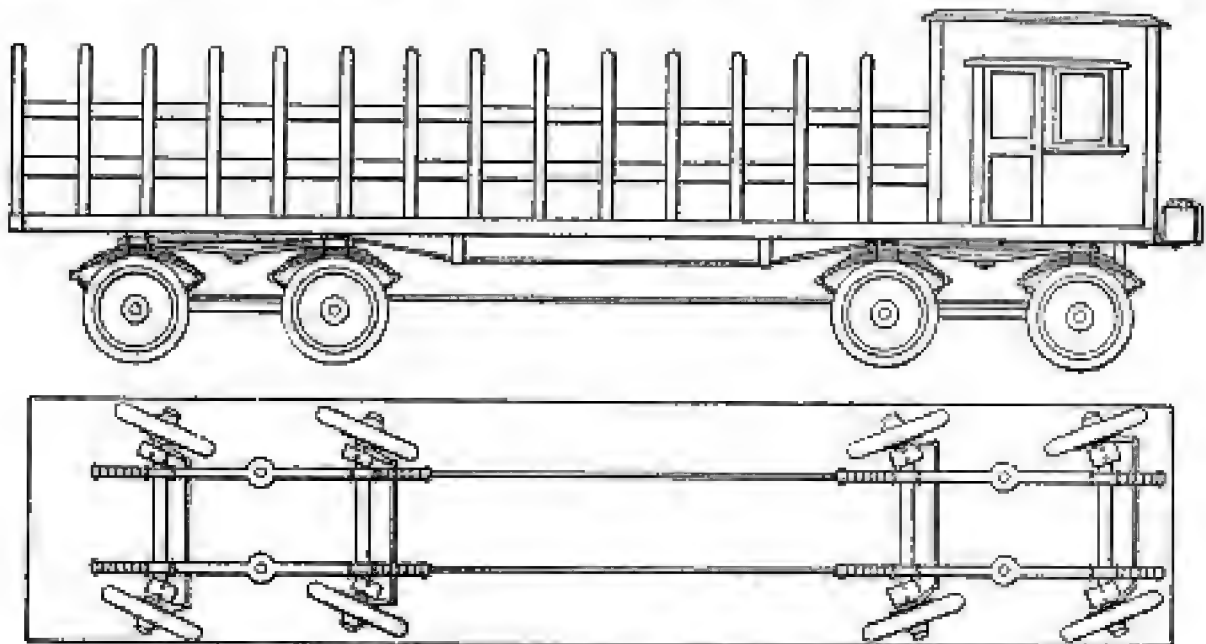
EIGHT-WHEELED ELECTRIC MOTOR TRUCK

A new type of electric motor truck, having eight wheels, each provided with an individual motor receiving power from a gasoline-electric generating plant, and with rear wheels that turn automatically with the

a long series of heavy scientific investigations.

The Navy Department found itself possessed of a lot of old brown powder at the Indian Head factory, down the Potomac River, a short distance from Washington. It was of a kind that was used several years ago and made a lot of smoke. It is known as "cocoa powder" because of its color and also because in its manufacture shredded cocoanut husk was used as a binder.

The navy people tried to trade it off to a big South American firm for nitrate to be used in making the new



An Exceptionally Large Gasoline-Electric Truck Having Eight Steering and Drive Wheels. Each Wheel Has Its Own Motor, Located on the Steering Knuckle

front wheels in steering, has been designed by a Minneapolis, Minn., inventor. The motor for each wheel is located on the steering knuckle so that it swings with the wheel, thus doing away with the necessity of the universal joint and differential gear.

GUNPOWDER USED AS FERTILIZER

Gunpowder for raising crops is the latest thing under test in Washington, two great arms of the government, the Navy Department and the Department of Agriculture, being interested in the experiment. It all came about quite accidentally and was not the result of

smokeless powder, but the Chilean importers could not see it even though revolutions in that part of the world are not infrequent and most any kind of powder will serve for a hastily hatched uprising. A bright young naval officer determined to get rid of the powder. There was a million and a half pounds of it on hand and it contained about 80 per cent potassium nitrate, a most valuable fertilizer constituent.

The officer went to the Department of Agriculture and offered them the explosive. The scientists there said that theoretically such powder was a good fertilizer, but that they really did not care to try it at their experiment

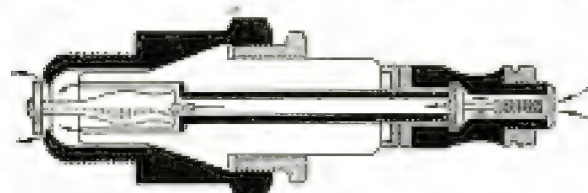
farms, powder being decidedly out of their peaceful line of business. However, they were deeply interested and would like to see some of it tried on crops, suggesting Indian Head and some of the army posts as the most appropriate places for the trials.

So the navy folk mixed up a lot of the stuff with Potomac River water, fresh from the end of the wharf at Indian Head, and saturated the truck garden which is maintained there for the benefit of the officers and their families. The results were astonishing according to the Indian Head people. They grew vegetables which they declare vied in color and perfection with the choicest lithographed specimens which adorn the seed catalogues.

This year the experiment is being tried on a larger scale and with equal success on the gardens and lawns at Fort Hunt and Fort Washington, two of Washington's defenses down the Potomac. What might happen if officers should smoke on the parade grounds treated with the powder solution can only be guessed, but no one seems to be worrying about it. Meanwhile the conservative Agricultural Department looks on and applauds, but so far there has been no requisition on Indian Head for old powder for the experiment stations.

AIR-COOLED SPARK PLUGS

A spark plug described as "air-cooled" has recently been placed on the market in Germany. Although differing little from the conventional pat-



Air-Cooled Spark Plug Being Marketed in Germany

tern, this plug incorporates a distinct innovation, the central metal spindle, which carries the current to the interior of the cylinder, being bored for about three-quarters of its length, while at

the point where the hole terminates are two small perforations which extend to the outside. These small holes provide an escape for the air which is drawn through the spindle. A check valve, housed in the brass cap of the plug, permits the free ingress of a certain amount of air on the suction stroke of the motor, but closes tightly to prevent the escape of gas during the working stroke. It is claimed that the air so admitted maintains the plug at a temperature considerably below that of the ordinary plug.

BUILDING STONE MADE OF BLAST-FURNACE SLAG

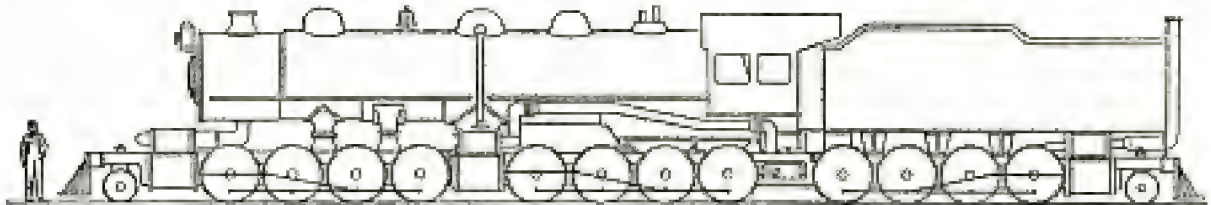
An industry now assuming considerable importance in Germany is the manufacture of building stone from blast-furnace slag. According to The Engineer, London, the process is not patented, and is very simple in details. Practically all blast-furnace slag is suitable for stone making, but it must be in a granulated state, being unsuitable after it has been allowed to harden. All attempts to utilize slag that has been crushed or ground, after having been once hardened, have failed to produce a good solid stone.

In the process here referred to, the slag is granulated by the addition of water as it flows hot from the furnace. The granulated slag is then, after being thoroughly mixed with the required proportion of lime, allowed to stand one hour before being put through the forming press. After being pressed the stones are slacked in the open air, and, after three or four weeks, according to the weather, they are ready for use. Under low temperature they harden slowly, and if subjected to frost before thoroughly hardening, they crumble and are ruined. Otherwise, the stones grow constantly harder with time.

Russian laws dealing with false weights are so severe that in one province merchants who violate the law are prohibited from participating in any kind of trade.

TRIPLEX COMPOUND LOCOMOTIVE

The design of a locomotive, which is practically an ordinary Mallet with working tender, but instead of having the high and low-pressure cylinders of different size, has a pair of high-pres-



A Proposed Triplex Compound Locomotive

sure cylinders attached to the frames connected with the back part of the boiler, and two pairs of low-pressure cylinders, one in front and one at the rear of the tender, all the cylinders being of the same size, is shown in the accompanying illustration. With this arrangement a compounding ratio of two to one is obtained, and it is found that, with but a slight increase in the weight and cost, and without any increase in length, about 50 per cent more tractive effort is obtained, the working tender being so arranged that, with only 25 per cent of fuel and water remaining, there will be sufficient weight to give the full adhesion. The weight of such a tender with a 25-per-cent load would be over 100,000 lb.

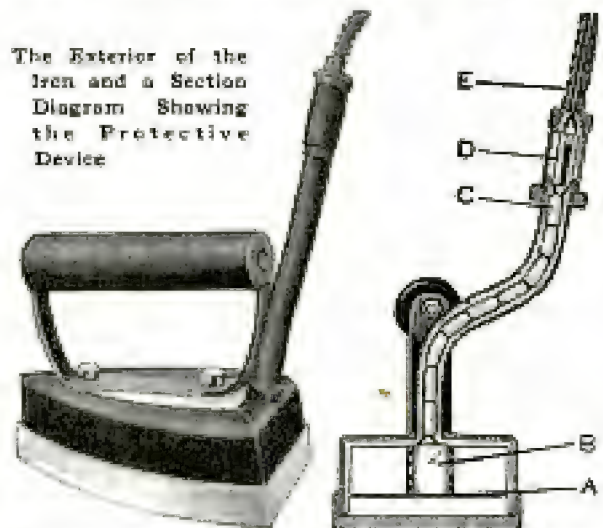
The horizontal pipe with a ball joint in the cylinder saddle, which takes the exhaust from the high-pressure cylinders, has, according to the *Railway Gazette*, given practically no trouble in Mallets now in service, and this is simply duplicated in the rear of the new design by making a pocket with a ball joint in the footplate and taking the exhaust steam from the high-pressure cylinders back to this footplate, as well as forward to the front cylinders. The object of placing the cylinders on the tender at the rear end, is to make the swivel pipe, which has the ball joint in the footplate and which corresponds to the receiver pipe, connecting the high and low-pressure cylinders at the front of the engine, of suitable length.

HEAT PROTECTION FOR ELECTRIC FLATIRON

A new type of electric iron, designed especially to meet the severe conditions which obtain in laundries and dry-cleaning shops, is shown in the drawing. It is fitted with a special at-

tachment arranged in such a manner that the combustible insulating covering of the flexible lead is protected at the points likely to become so hot that the insulation may be damaged. The two wires leading from the heating element A are brought into a porcelain connector, B, which consists of two solid-brass terminals imbedded in porcelain, the wires being held in position by setscrews, without soldering. These terminals are connected at the top by two copper wires, which are carried in iron tubing and are insulated by being

The Exterior of the
Iron and a Section
Diagram Showing
the Protective
Device



threaded through small pieces of porcelain, C. These pieces of porcelain abut closely together, so that there is no possibility of the two leads accidentally becoming short-circuited. The two copper wires terminate in a second connector, D, to which the flexible lead E is attached.

CALCULATING THE CIRCUMFERENCE OF THE UNIVERSE

By FOREST RAY MOULTON

The diameter of the part of the physical universe which has been penetrated by the most powerful telescopes of modern times is about the distance light travels in 10,000 years. Now light travels 186,330 miles per second, there are 86,400 seconds in a day, and there are $365\frac{1}{4}$ days in a year. If the diameter of the universe were exactly known, would mathematicians be able to compute its circumference with an accuracy meeting all requirements? For example, could they compute it within $1/100,000$ th of an inch, so that the error in their results could not be detected with the most powerful microscopes in existence?

The approximate length of the circumference of a circle is obtained by multiplying its diameter by $3\frac{1}{7}$. This result is a little larger than the true value. A more nearly correct result is obtained by multiplying the diameter by 3.1416. While this result is exact enough for most engineering and other practical problems, the error would be important in computing the circumference of the universe. A still more nearly correct value of the multiplier is 3.14159265, which is accurate enough for all ordinary scientific purposes of the present time, but the results are not absolutely correct.

One may ask, then, what number should be used in order to get the exact circumference when the diameter is given. Mathematicians have proved that, unfortunately, the exact number can not be expressed by a finite number of figures, either as a decimal or as an ordinary fraction. If the number were expressible as an ordinary fraction, then, when it is reduced to the decimal form, it would be found that the same figures repeat themselves in the same order over and over again. For instance, if the number were $3\frac{1}{7}$, in the decimal form it would be written 3.142857, where the omitted part consists of the figures

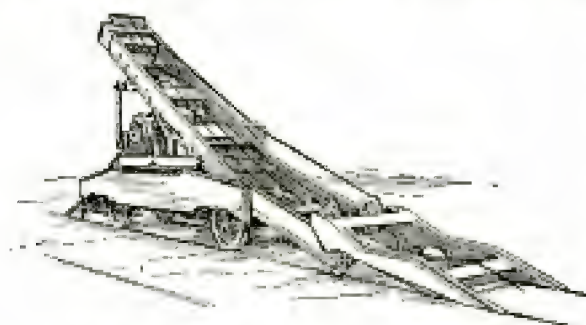
142857 repeated over and over indefinitely. In a similar manner, every other number which can be expressed as an ordinary fraction goes into a decimal which contains a similar cycle, generally of fewer figures. The number $1/5$ goes into a decimal whose repeating cycle is simply 0. Now, the number to be used to compute exactly the circumference of a circle cannot be expressed as an ordinary fraction or as a decimal which repeats in the manner indicated. Such numbers are called by mathematicians "transcendental numbers," and must be computed in detail as far as they are desired.

The number which must be used in finding the circumference of a circle from its diameter has been the object of much attention on the part of mathematicians and computers. It has been most exactly determined by W. Shanks, an Englishman, who computed it to 707 decimal places. This is not only far beyond the actual requirements of all science at the present time, but it seems certain that it will always remain so; for, it is found that if it were known only to 30 decimal places, the circumference of the universe could be computed with an accuracy so great that the error could not be detected with a microscope. Not only has the number been computed quite far enough, but mathematicians have wasted an enormous amount of time in getting the last 677 places.

☞ Headless safety matches have been manufactured for some time by a Danish match concern. One end of the little sticks of wood are dipped into a solution of chemicals for half a minute and then into water for a quarter of a minute. Like other safety matches, they cannot be ignited by friction in any way except against a specially prepared surface. The prepared end of the match is distinguished by being colored.

AN ELEVATING DEVICE FOR UNLOADING CARS

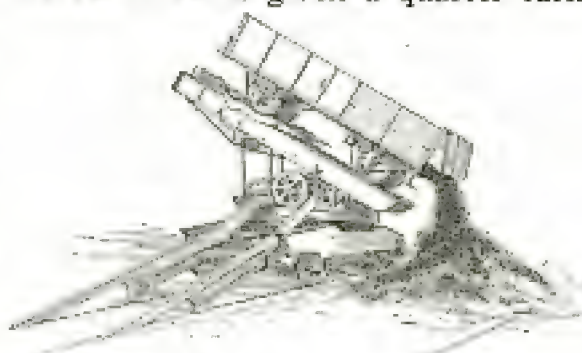
A car especially designed to elevate and dump cars loaded with coal, gravel, and like materials, is being used in Germany. It comprises a flatcar of especially strong construction, on which is mounted a turntable bearing rails. This turntable is capable of being swung completely around and can be tipped to an angle of 45 deg. Normally it is inclined at an angle of 30 deg., so as to form an unbroken line



A Car for Elevating and Unloading Gondola Cars

with the approaches on which the cars are drawn onto the turntable for unloading and are run from it after the

operation. Cables, driven by a motor, draw a car at a time onto the turntable, the turntable is given a quarter turn,



A Car Inclined by the Elevator and Discharging Its Load

its inclination is increased from 30 to 45 deg., and the load is allowed to discharge from the end of the car. Then the turntable is lowered again to the 30-deg. inclination, turned another quarter-revolution, and the empty car run off the table on a second set of approach rails. The operation of the turntable is executed by means of a second motor.

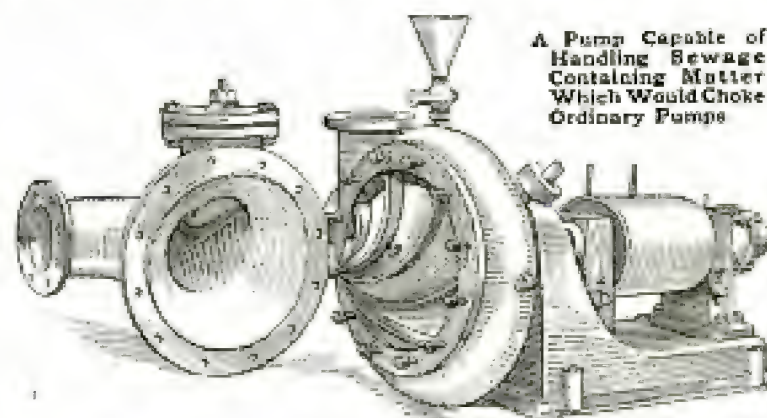
The idea is to provide each long coal train with an unloading device. It will elevate and unload six to eight cars an hour with ease.

PUMP DESIGNED SPECIALLY FOR SEWAGE

One of the greatest difficulties encountered in pumping sewage arises from the fact that great quantities of solid matter find their way into drain-

ever, a pump has been invented by an English engineer, which, it is claimed, will handle unscreened sewage of a consistency that would choke any

other type of pump. It is a special form of centrifugal pump described as "an eater of solids." It is claimed to have an efficiency approximating that of the ordinary centrifugal pump. From the illustration it may be seen that the pump consists of a centrifugal with a conical impeller, the discharge being from a whirlpool chamber of gradually in-



A Pump Capable of Handling Sewage Containing Matter Which Would Choke Ordinary Pumps

creasing size, as is usual. The impeller is provided with a number of spiral blades running out of the top of the cone, and is carried on a hor-

age systems, this matter often being of such nature as to interfere with the working of the ordinary reciprocating and centrifugal pumps. Recently, how-

horizontal shaft provided with a long bearing, and also with the necessary thrust bearing. Unlike the outflow from the ordinary centrifugal, the fluid

forced through the pump does not leave the impeller at right angles to the spindle, but in a direction corresponding to the taper of the conical impeller.

LETTERS STAMPED WITH INK INSTEAD OF STAMPS

The latest type of slot machine for stamping letters to be tried in London does not stick the ordinary postage



An English Postage Slot Machine Which Stamps a Letter with Ink Instead of Sticking the Usual Postage Stamp Upon It

stamp on the letter but stamps the letter in the same manner as the stamping machines used in a postoffice to cancel stamps. That is, when the sender inserts his letter in the machine, and places a penny in the slot, the envelope is impressed with a circle of red bearing the words "London, 1d. [one penny] postage paid," and also with the numerals designating the section of London in which the letter was stamped.

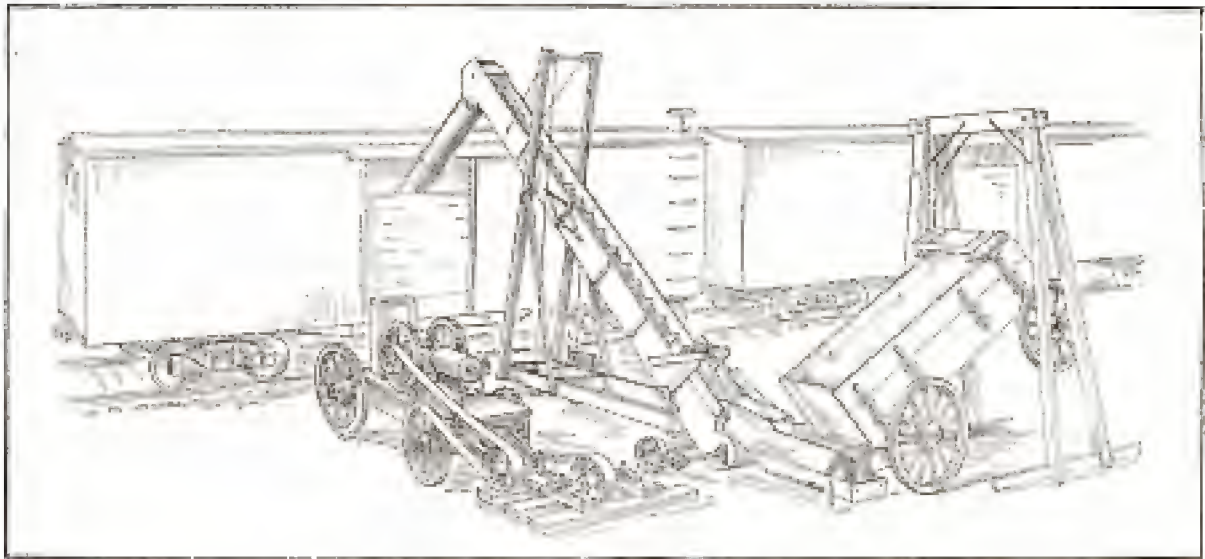
The river Amazon, according to the United States Geological Survey, carries to the Atlantic Ocean 618,000,000 tons of solution and sediment, traces of which can be observed 100 miles from land.

NEW GERMAN CANAL PROPOSED

A number of the Chambers of Commerce and influential manufacturers of Germany are advocating the construction of a canal through German territory from the Rhine to a German port on the North Sea. The commission which has been intrusted with the negotiations and plans proposes that the canal start from the Rhine at Wesel, thence run in a northerly direction between the Netherlands frontier and the river Ems and finally join this river opposite the town of Leer, a few miles from the mouth. The length of such a canal would be about 120 miles. In addition to the great advantage to German shipping and the immense strategical value, the canal would also facilitate the cultivation of the fens through which it would pass.

ABSORPTION BY GLASS IN X-RAY PHOTOGRAPHY

One of the chief reasons why X-ray photographs have poorly defined outlines is that the glass ordinarily used in X-ray apparatus absorbs as high as 52 to 70 per cent of the rays, according to its thickness. Sir J. J. Thomson, the noted British scientist, has advanced the theory that the absorption is directly proportional to the atomic weights of the substances entering into the composition of the glass. Working upon this basis, German chemists have now produced a glass which absorbs only 10 to 15 per cent of the X-rays, scarcely becomes heated or fluorescent, and produces no secondary rays. The X-ray photographs taken with apparatus in which tubes of this glass were used, are said to be very clear and distinct. Also, much shorter exposures are needed.



Loading Grain into Cars by Means of a Portable Elevator

PORTABLE GRAIN-LOADING ELEVATOR

Several portable grain-loading elevators, which may be operated by an electric motor or by a gasoline engine, are being used with considerable success by the Northern Illinois Electric Railway, which devotes special attention to the handling of grain on its line extending through the famous corn-belt of Illinois. Regulation steam-road freight cars, operated on the electric line, are placed on sidings, located at frequent intervals, and the farmers bring the grain to them in wagons.

The first of the elevators used was driven by a gasoline engine, but the lately installed similar machines are operated by electric motors, taking current from the trolley wire. The grain wagons are tilted in the manner shown, and the load feeds into the receiving box of the elevator. A wagon-load of grain can be transferred into a car in 10 min.

CA traveler recently returned from China states he was astounded to learn that people in the interior who can speak no language but Chinese are yet thoroughly familiar with the life and work of George Washington, excellent biographies and reviews of his achievements having been published in Chinese.

THIEF-PROOF RACK FOR TOOLS

A stand tool rack provided with a means for preventing the mysterious disappearance of shop tools is shown in the accompanying drawing. The larger tools are held in the circular rack by dropping the handles through the slots, and in the center is a shallow



A Tool Rack Provided with a Top Which is Padlocked Over the Heads of the Tools to Prevent Their Removal

low tray for smaller tools. The tools are locked in place by swinging a large circular steel cover over them and padlocking it.



METAL WORK AND ETCHING

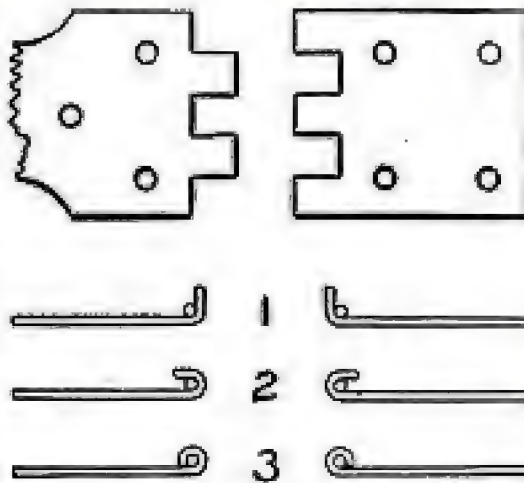
By JOHN D. ADAMS

PART X—Hinges and Drawer Pulls

THE making of arts-and-crafts furniture is now an important item in all manual training courses, and is probably one of the most popular of handicrafts among amateurs in general. This class of furniture demands a distinctive style of hardware. In fact, in the absence of the usual machine-made ornaments, the hardware is about the only added decorative feature.

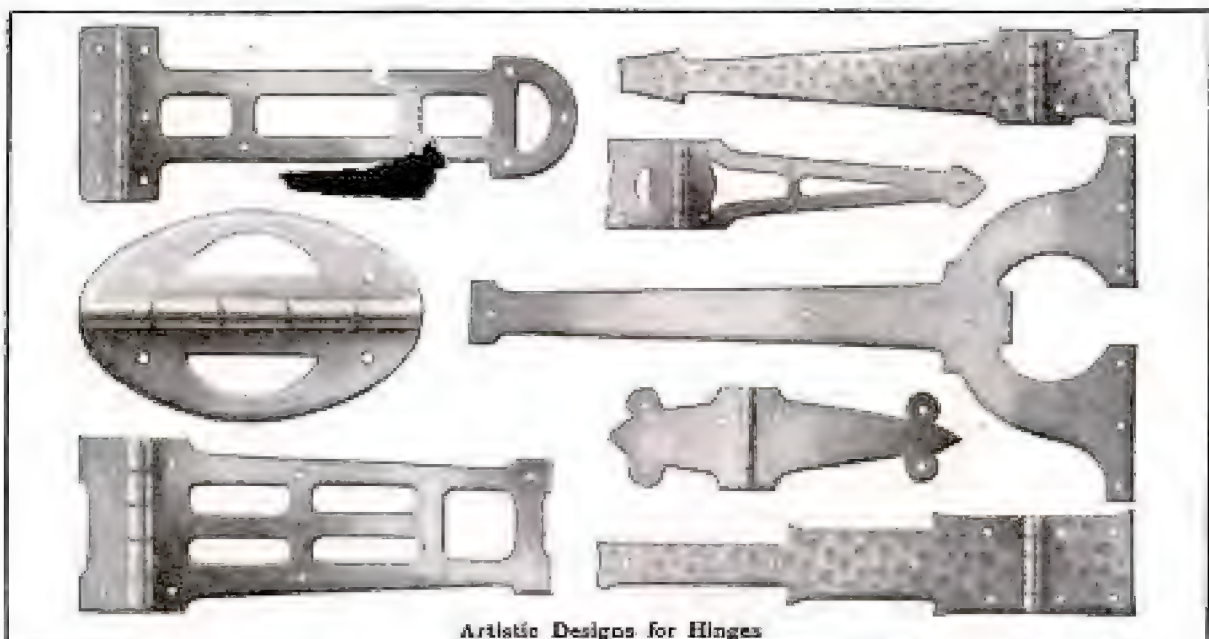
The accompanying illustrations may serve to point out what can be done in the way of

hinges—either real or imitation. The latter, used in connection with butt hinges, are merely plates of brass or copper appropriately shaped and attached with large-headed nails. In making the real hinge, we must first make an accurate full-size drawing, showing the pattern and the projecting lugs as in the working drawing. As a rule, three of these are integral with the stationary portion, and



Hinge Patterns and Stages of Construction

the remaining two form a part of the swinging half.



Artistic Designs for Hinges

With thin metal, say, No. 20 gauge, the piece may be cut out with the tin snips, but for the heavier gauges the saw must be used. Where portions are to be cut from the interior, a hole must first be drilled so that the saw blade can be inserted. A short piece of board, 3 in. wide, with a notch in the end, should be nailed or clamped to the bench, so as to overhang about 4 or 5 in. This will prove a great convenience when sawing, as it will firmly support the metal while the saw is moved up and down through the slot. Place the saw in the frame

so as to cut on the down stroke. On the larger hinges and where the shape will permit, the edges should be bent over slightly with the hammer, so as to give the appearance of thickness. When the projecting lugs are all filed up square and properly fitted, the bending should be done. The various stages are indicated in the drawing. After stage two has been reached, a straight wire nail should be inserted and the piece hammered closely around it. Some further filing will then be necessary in order to get the two sides to fit properly together. This accomplished, however, nothing more remains than to fit in the pin and trim off its ends, which should then be slightly burred to prevent it from falling out. The wire

nail used in forming the lugs may serve as a pin, provided it is perfectly straight and the head is cut off.

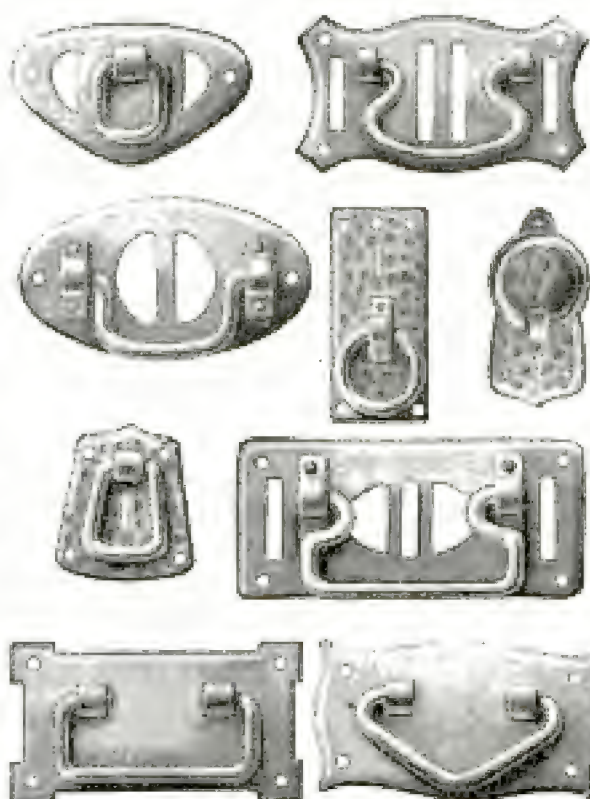
The etching process is rarely applied to hinges, but the several coloring solutions, heretofore described, may be applied according to the effect desired. Plain lemon brass and hammered copper are popular finishes. Lacquer is used in all cases.

Drawer Pulls

There is probably no article within the scope of home metal work, in the making of which the efforts of the amateur show up to better advantage

than in the case of arts-and-crafts drawer pulls. From the illustration of nine specimens some idea may be gained of the variety obtainable; and, as both brass and copper are available, and these in various finishes, the artistic possibilities will be evident. A piece of mission furniture of pleasing design, though made by an amateur and from pine lumber, will, when properly stained and fitted with this handmade hardware, present an attractive appearance.

The gauge of the metal may be about No. 16 for average sizes. When it is desired to keep the piece perfectly flat, all the cutting should be done with the metal saw. Interior openings require the drilling of a hole for the insertion of the saw blade, the end of which is



Designs for Drawer Pulls



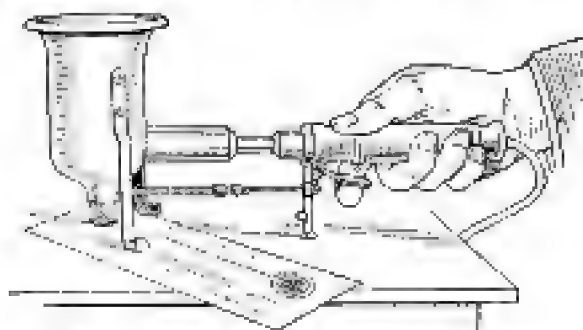
Cross-Sections Showing Construction of Drawer Pulls

then reconnected to its frame. The handles are of brass or copper rod, bent over wood and using a wooden mallet, so as to avoid marring them. These are connected to the plate by either of three methods, as shown. In the first method, the metal strip is first snugly bent around the handle and then the two ends are inserted into the small rectangular opening in the plate, where the ends are bent over and hammered flat. In the second method, a

plain riveted strap is used. In the third, the strap is closely fitted around the handle and the two ends spread apart and drilled for the rivets. Where the size and pattern permit, the edges of the plate are to be beveled over with the mallet so as to give the plate the appearance of having considerable thickness. If the pulls are to be used in connection with the hinges previously described, the finish and metal should, of course, be the same.

ELECTRIC WAX MELTER AND DROPPER

An electric device for melting and dropping the wax used in sealing letters or packages is being marketed by an electrical concern in Buffalo, N. Y.



Wax Melter and Dropper for Putting Seals on Letters and Packages

It is designed especially for banks, express offices and shippers of large numbers of packages that require a wax seal, and is much cleaner and quicker than the old methods.

COATING IRON PIPES WITH LEAD

An English inventor has developed a new and cheap process by means of which a coating of lead of any thickness desired may be applied to iron. The weight of lead deposited can be varied from a fraction of an ounce to any weight up to several pounds per foot of surface. His process enables the coating to be applied to a variety of purposes, such as the lining of iron pipes, inside, outside, or both, used for the conveyance of corrosive

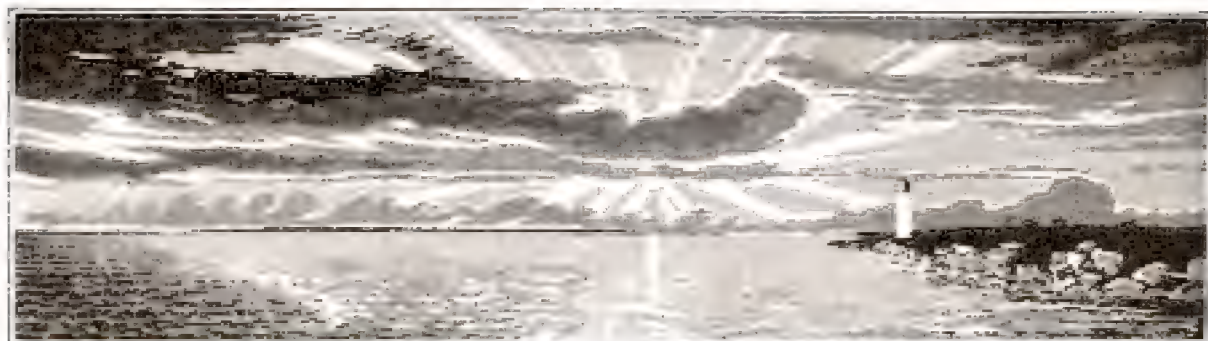
liquids; the lining of pumps, chemical vessels, etc.

Hitherto the coating of iron and steel surfaces with lead has been almost exclusively confined to the production of terneplate, as the thickness of lead which could be applied was within narrow limits.

COALING BARGE MIXES THE COAL AUTOMATICALLY

Economy in the steamship consumption of coal often requires that two kinds of coal be mixed in a certain fixed proportion, and to expedite coaling under such requirements a concern in Liverpool, England, has constructed several automatic coaling barges which mix two classes of coal in different proportions as required. In these barges an endless chain of buckets runs over and under the coal compartments, receiving coal as they pass under the compartments. The doors in the bottom of the compartments through which the coal drops into the buckets can be opened or shut instantaneously by operation from the deck. The coal undergoes an automatic mixing process in its progress through the compartments to the doors, and then the mixing process is made complete as the coal from the buckets passes through the chutes into a steamship's bunkers.

¶ The long-distance balloon record has been awarded by the Aero Club of France to Emile Dubonnet, for a flight of 1,314 miles.



The Wonders of Light

By J. GORDON OGDEN, Ph. D.

V—Vision

This is the fifth of a series of articles by the author of "Heat" and "The Kingdom of Dust," which have appeared in this Magazine. Dr. Ogden is professor of physics in the Fifth Avenue High School, Pittsburg, Pa.

LIKE every other function of the higher organisms, vision is a product of evolution. When we study the complicated parts and highly specialized mechanism of the human eye, we have only to turn to the seeing apparatus of the lower animals to perceive the beginnings of structures that reach their highest development in "the heir of all the ages, in the foremost files of time."

Life existed on this planet for myriads of centuries in total blindness. Formless masses of protoplasm in the slimy ooze of ancient oceans moved to and fro on the ocean bottom, without a vestige of an organ of vision. As we go down the steps of animal life as we know it to-day, one by one the marvelous differentiation, or setting apart, of certain portions of the organism for the purpose of vision disappear. Finally, in the very lowest forms of life, in the remotest and deepest subcellar of

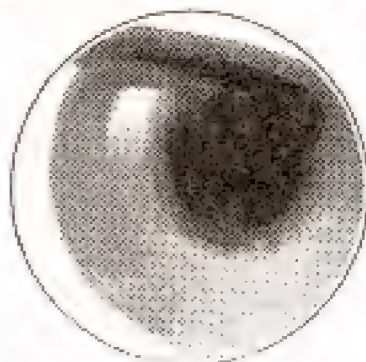
creation, down at the bottom of the steps, we come to those curious beginnings of life—mere splotches of protoplasm, barely within the confines of living matter, and absolutely without visual apparatus. At least, the highest powers of the microscope fail to reveal anything of the kind.

For ages the beating of light waves upon these primitive smears of life had no effect other than that of, possibly, a slight stimulation on the rudimentary nervous system. Finally, through all the æons of time that our earth

has been in existence, this constant pounding on the closed doors of sense perception had its effect. The first eye to open could hardly be called an eye. A tiny speck of pigment appeared whose special function seemed to be that of responding to the incessant summons of the light waves. In *Euglena*, Fig. 1, a microscopic animal that gives a greenish color to the pools of water



According to the Theory of Mosaic Vision, Each of the Visual Rods in the Retina of the Eye Takes Up a Part of the Object Which We See, the Whole Being Blended Together



An Enlarged View of the Engraving of the Eye Shown Above. Dots cannot be Seen in Top View, but are Very Plain in Lower. This is a Fine Illustration of the Mosaic Theory

that it inhabits, appears a tiny "eye spot" that seems to be the humble beginning of an organ designed for vision alone. It is the first step on the way to the development of a sense that gives to the living world the faculty of sight.

No one knows how many ages, how many cycles of time, elapsed before the human eye with its marvelous lens and magic retina made possible the glories of the rainbow, the wondrous colors of a sunset, and all the other beautiful phenomena attendant upon the tiny ether waves known as light.

It is quite probable that all eyeless animals have the power of distinguishing light from darkness. The maggots from which the common housefly originates will wriggle away from light and seek refuge in the darkest crannies. The hydra (Fig. 2), a tiny, green or yellow, fresh-water polyp, if placed in a black bottle filled with water, will attach itself to any part of the glass where the light may filter through. Even a plant will turn toward the light, as everyone knows who has observed a potato or geranium growing in a cellar window. This, however, is not vision. A picture-forming eye must have a lens in order that the light rays may be concentrated. Some form of nerve tissue is also needed in order that the light's tiny quiverings may be perceived.

The crayfish, commonly known as the "crawfish," has a wonderfully complex visual equipment. The two eyes possessed by this humble invertebrate, are really compound eyes. Figure 3 represents a vertical section of the eye stalk of the crayfish, and Fig. 4, a

highly magnified portion of the same stalk, showing the cones, spindles, and optic nerve. Each of the paddle-shaped crystalline cones is an eye in itself, separated from all the other eyes by a dark zone of pigment. These cones are not hollow tubes. On the contrary, they are solid rods of high refractive power. As many images are borne to the central nervous system of the crayfish as there are individual visual rods. Does the crayfish, there-

fore, see multiplied images of an object? When an enemy or friend approaches, does it see a legion of its acquaintances, and is its whole horizon taken up with tiny pictures of its casual callers?

When we consider that the common ant has 100 such eyes; the housefly 8,000, and the dragonfly, 28,000, the question of compound vision is interesting, to say the least. No wonder that a fly is so elusive with its tremendous battery of eyes, giving a range of vision through a very wide angle.

It is quite likely, as demonstrated by Johannes Müller, that compound eyes do not play the part of simple eyes. Each of the 8,000 images or pictures formed by the facets of a housefly's eyes

is not an image of an entire object, but only of a part. These parts are fitted together in somewhat the same manner as the irregular bits of colored glass and stone are harmonized into the beautiful mosaic pictures of mediæval Italy. Figure 7 shows very clearly the principle of mosaic vision. Only a few rays of light from any point on an object can reach the optic nerve, and these rays must enter perpendicularly to the cornea. Hence, there is little or no confusion of images, and

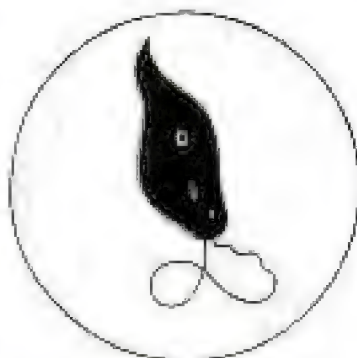


Fig. 1—Euglena, Microscopic Animal with "Eye Spot"



Fig. 2—The Hydra, Low Form of Life Turning toward Light

each point in an object occupies the same relative position in the mosaic image thus formed.

The human eye, Fig. 8, while it appears to be quite different from the compound eye of the crayfish, has a fundamental resemblance to it, as Huxley has pointed out. In order that we may understand what is really a close relationship, let us review, briefly, the structure of the vertebrate eye, especially that of man.

A human eye is like a camera. It has a lens to gather the light rays to a focus. It has an adjustable screen, or iris, for regulating the amount of light that shall enter. It has a sensitive film affected by the physical or chemical action of the light. Like the camera and all other optical instruments, its interior is dark and lined with black, in order that there may be no unwanted internal reflections with consequent multiplied images. Again, unlike the camera, the eye does not depend upon the lens alone for its light concentration, for the thin, transparent skin which covers the pupil, and is known as the cornea, has also the power of refraction. Furthermore, two fluids in the eye, one in the front, known as the aqueous humor, and one in the main chamber, known as the vitreous humor and occupying about four-fifths of the bulk of the eye, have likewise the power of bending the light rays that pass through them. All of these refractive media work in conjunction, with each other and with the various muscles and nerves, to produce a sharp, clean-cut image upon the retina.

The retina, shown in cross section in Fig. 9, is, perhaps, the most complicated, the most marvelous, of all of nature's handiwork. It is the apex of the pyramid of creation. The retina of

the human eye, although it is but one-eightieth of an inch in thickness, is made up of 10 distinct layers, each of which has some distinct function in the business of the eye—that of receiving the rays of light, permitting them to make certain, probably, chemical changes, and transmitting the effect to the brain.

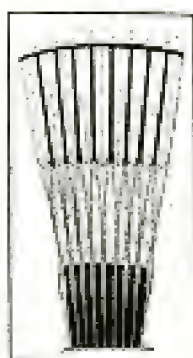
While physiologists are not of one accord as to the effect of light waves upon the retina, it is generally admitted that the ninth layer, which is made up of rods and cones, has a most important part in the mechanics of vision. The retina is really a network of almost immeasurably small branches of the optic nerve. It is made up of delicate nerve fibers, numbering no less than 800,000. For each fiber there are seven cones, 100 rods, and seven pigment cells. Let the reader multiply the numbers of fibers, cones, rods, and pigment cells, and call to mind that this myriad of complex structures are packed into a space less than one-fivehundredth part of an inch in thickness, and he will gain some idea of the wonderfully intricate construction of the apparatus which serves the priceless gift of sight.

To gain a better conception of the rods and cones, and their functions, let us quote from Professor Bidwell, an English scientist of note: "Imagine a small portion of the inner surface of the eyeball, one-tenth of an inch square, to be magnified 2,000 diameters (four million times), and let the enlarged area be represented by a floor of a room, 17 ft. square. Procure a quantity of cedar pencils, and set them on the floor in an upright position and very close to one another. It will be found that the number of pencils required to fill the space will be about half a million. To make the analogy more complete, let



Fig. 3 (Upper View) - Magnified Vertical Section of Eye Stalk of Crayfish

Fig. 4 (Lower View) - Highly Magnified Portion of Same Stalk, Showing Cones and Spindles



some of the pencils be sharpened to a long tapering point at their lower ends, the greater number remaining uncut, just as received from the manufacturers. Neglecting details, which may be regarded as immaterial for our present purpose, we may consider the uncut points as representing, upon an enormously magnified scale, the rods of the retina, and the pointed ones, the cones. The flat upper ends of the pencils may be painted in different uniform colors, and arranged so as to form a large picture in mosaic; if this is looked at from such a distance that its image is a tenth of an inch square (which will be the case when the picture is about 40 yd. away), all possibility of distinguishing the separate elements which comprise it will be lost, and the picture will seem to be a perfectly continuous one. Although the light which enters the eye cannot reach the rods and cones until it has traversed all the other layers of the retina, yet these intervening layers, being transparent, offer little obstruction to its passage, and it can hardly be doubted that the rods and cones are the special organs upon which light exerts its action, the picture focused upon their ends being in truth an exceedingly fine mosaic."

There are various theories concerning what takes place when the ether waves enter the rods and cones. Some scientists hold the opinion that the energy of the light waves is transformed

into electrical energy, and that the visual stimulus is electrical. Others believe in the photo-mechanical theory, according to which the pigmented cells in the retina, forced out of their shape and volume by the mechanical action of light, press upon the rods and cones, thus producing a stimulation.

The most probable theory, however, is that which is known as the photo-chemical.

According to this theory the light waves produce a chemical change in the rods and cones, causing impulses which ascend the optic nerve to the brain. There is, in the retina, a peculiar substance known as rhodopsin or

"visual purple." It bleaches under the influence of strong light, but is regenerated quite rapidly. Boll, its discoverer, claimed that this vision purple furnishes absolute proof of the photo-chemical theory of vision. The elaborate researches of Kühne have weakened this belief considerably. The function of the purple seems to be that of rendering the eye sensitive to very faint light. All nocturnal animals, with the exception of the bat, possess this peculiar compound to a marked degree.

The photo-chemical function of the purple is shown in Fig. 10. If the strong light from a barred

window is permitted to fall upon the retina of a rabbit, the eye quickly removed, and the retina "fixed" with a solution of alum, the purple will show the barred effect portrayed in the il-

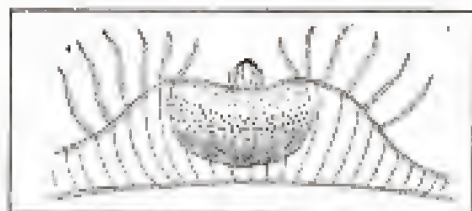


Fig. 5—Magnified View of Section of Simple Eye of Jellyfish

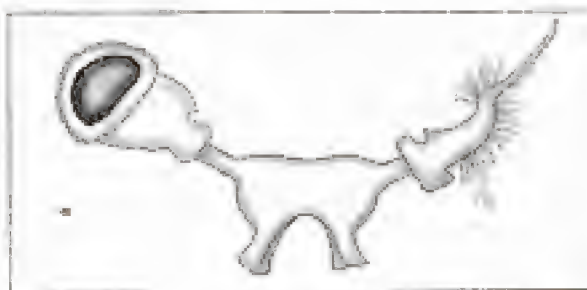


Fig. 6—Eye Stalks of a Decapod. The Compound Eye on the Right has been Lost, and in Its Place the Animal has Regenerated an Antenna—After Herbst



Fig. 7—Diagram Showing the Theory of Mosaic Vision. Practically Only One Ray of Light from Any Point may Enter the Visual Rods, Which are Supposed to be Hollow Tubes

lustration, a permanent "photogram." In the center of the retina, quite near to the optic axis, is the "yellow spot," the most sensitive area of the eye. In the center of the "yellow spot" the rods are absent. About a tenth of an inch from this point, the optic nerve enters the eye, and the retina is incomplete in this area, forming what is known as the "blind spot." Figure 11 affords an opportunity of demonstrating the existence of the "blind spot," if the directions under the illustration are faithfully obeyed.

Man's eye is an improvement upon those of the lower forms of animal life, but it is by no means a new thing under the sun. As before noted, Huxley has called attention to the fact that it is not such a far cry from the wonderful eye of man to the equally wonderful eye of the crayfish.

It is quite likely that the human eye is at present in a transitional stage of development; otherwise it would be difficult to account for its many defects as an optical instrument, unless we

* choose to regard these defects as the results of compromises whereby the best average results are obtained. An exposition of a few of these defects may not be uninteresting. For example, no human eye has any adequate means for the proper correction of what is known as "chromatic aberration" or, in plain language, it lacks the power of bringing all colors to the same focus. Were the eye corrected for this defect, vision would be clearer. One would not see the violet haze around the opal globes of the arc light in the streets. A red spot upon a violet ground would not appear to be raised above the surface, nor would a violet spot upon a red ground appear to be depressed, if the eye brought all the colors to the same focus. A room that is papered or painted a blue-violet color appears to be larger than when its coloring is red. This is likewise a result of chromatic aberration.

Another defect of the eye is known as astigmatism. As

the term is ordinarily used, astigmatism is caused by an irregularity

in the curvature of the cornea. The

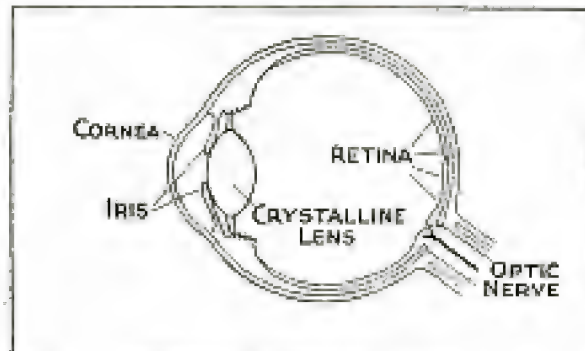


Fig. 8—The Human Eye, Normal Vision, Showing All the Important Parts

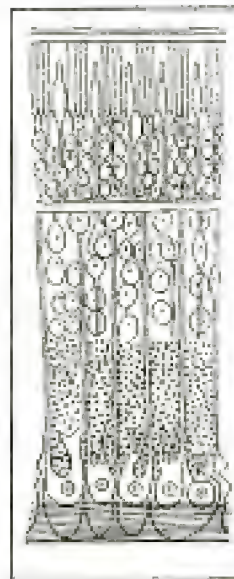


Fig. 9—Cross Section of Human Retina. Note Rods and Cones in the Upper Layer



Fig. 10—"Photogram," Showing the Effect Produced on the Visual Purple of the Retina of a Rabbit, by the Action of a Strong Light from a Barred Window



Fig. 11—The Blind Spot. Close the Left Eye. Look Steadily at the Cross. A Position can be Found, by Moving the Book toward or from You, Where the Circle will Disappear. The Image of the Circle is Then on the "Blind Spot"

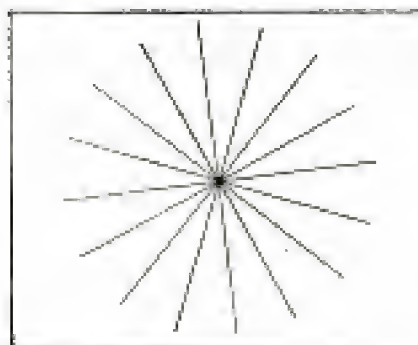


Fig. 12—These Lines are All of the Same Degree of Blackness. They Do not Appear so to an Eye Afflicted with Astigmatism

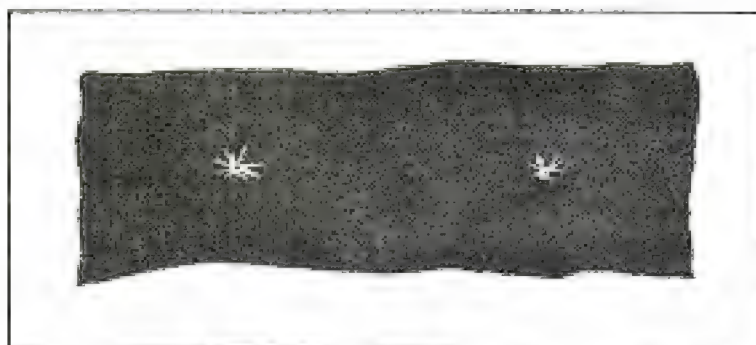


Fig. 13—Irregular Astigmatism. This Peculiar Effect may be Perceived by Looking at a Light through a Minute Circular Hole in a Piece of Tinfoil

cornea is shaped more or less like the bowl of a spoon, its curvature being greater vertically than horizontally. As a result the eye is unable to bring to a sharp focus all the parts of two lines crossing each other at right angles. One line generally appears to be heavy and distinct, while the other has a slightly hazy appearance. This form of astigmatism as revealed by Fig.

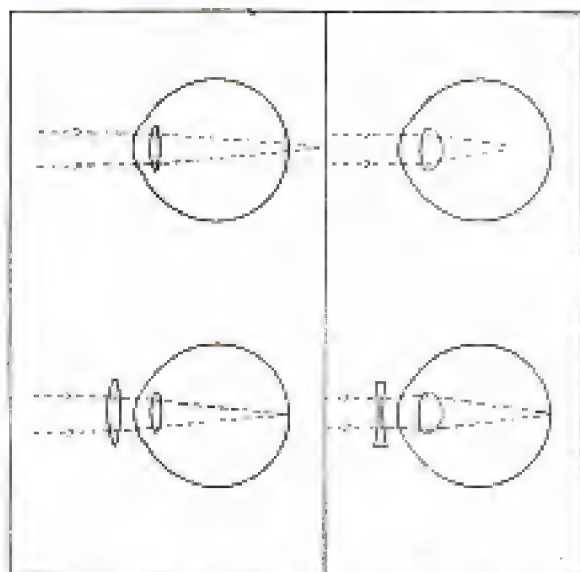


Fig. 14

Fig. 15

Fig. 14—"Far Sight," Due to Flattening of Crystalline Lens. The Lower Drawing Shows How This Defect may be Remedied with the Lens of Eyeglasses

Fig. 15—"Short Sight," Due to Extreme Curvature of Crystalline Lens. The Lower Drawing Shows How This Defect may be Remedied with Convex-Lens Eyeglasses

12 may be corrected by the use of cylindrical glasses.

There is another form of astigmatism, however, that cannot be corrected. It is known as "irregular"

astigmatism, and practically every man, woman, and child is a victim of it. Fortunately, it is not of much importance and bothers no one, unless it is very marked. It is usually due to the peculiar construction of the crystalline lens, in that this important part of the eye is not of the same density throughout, but is made up of a number of separate portions of different densities, pieced together. In other cases it may depend upon irregularities in the curvature of the cornea. The demonstration of irregular astigmatism is a very simple matter. With a fine needle, pierce a small, circular hole in a bit of tinfoil. Close one eye, and with the other, look at a bright light through the hole in the foil, keeping the foil about ten inches from the eye. The hole will not appear to be circular, but jagged and uneven. If you bring the foil an inch or two nearer, the hole will appear to be star-like in form, as shown in Fig. 13. Irregular astigmatism is responsible for the "star-like" appearance of the stars in the heavens, as with perfect vision, the stars would be simply luminous points, devoid of the "rays" that appear to emanate from them.

Other defects of vision are the familiar "far-sight" and "short-sight." They are generally ascribed to a congenital shortening of the whole eyeball, in the case of farsightedness in young people, and an elongation of the whole eyeball in myopes. Far-sight, in old people, again is ascribed to flattening of the lens,

caused by hardening and contraction thereof; which phenomenon also takes place in myopic people, so that the farsighted require convex lenses of increasing strength, while myopes require concave lenses of decreasing strength, and sometimes, in old age, have to use convex lenses. The application of suitable lenses for the correc-

tion of these defects is shown in Figs. 14 and 15.

Let us hope that in spite of the obvious misuse of our eyes, and the tendency to over-light our homes with the advent of cheaper and more powerful artificial illumination, the coming man will take better care of the "windows of his soul."



Beautiful Plaza Design Planned for New York End of Manhattan Bridge, Connecting New York City Proper with Brooklyn

THE PLAZA PLANNED FOR MANHATTAN BRIDGE

The plan for the Manhattan Bridge plaza, New York, is probably the most artistic treatment of a bridge entrance that has yet been attempted on this continent. In Europe such plazas have been given a great deal of attention, but up to the present time, with few exceptions, such artistic features have been neglected in America. The archway is somewhat similar to the arch at Porte St. Denis, Paris, and the treatment of it suggests the Arc de Triomphe. The elliptical effect will remind those who have been in Rome of the colonnade at St. Peter's.

The details of the plan call for sidewalks laid out with warm-colored

mosaics and crossings lined off in similar manner, which will add much to the appearance of the plaza. The plaza parks are planned to be raised above the adjoining streets to a height of from 5 to 8 ft., surrounded by granite walls with granite balustrades. Steps will lead up to the park space at several points. The main walks through the parks to the entrance of the bridge will be of bluestone flagging and the pathways of white pebbles.

The transportation facilities of the plaza were made the subject of much study, the architects and the engineers constantly coöperating. Subway

trains coming off the bridge on the lower four tracks will pass directly under the plaza and directly under the arch. The surface cars, which are shown on the easterly or upstream side of the bridge, pass around the colonnade to the east and are taken to Canal Street. The illustration shows the westerly or downstream tracks

placed on the upper deck devoted to elevated-train service. This is merely an alternative treatment to show how this connection can be made. The original plan showed a terminal building here for the Brooklyn surface lines, and the plaza has been treated so that it will be in harmony with either scheme.

ELECTRIC TRUCK AS STREET-LIGHTING DEMONSTRATOR

That the electric truck can be used with success as a demonstrator of street electric lighting has been shown by the contract department of the electric company furnishing Dayton, Ohio, with illumination. Also, it puts street illumination in the same class as commodities that are directly demonstrable.

Trotwood, Ohio, a little city eight miles north of Dayton, became interested in electric street lighting, and the Dayton company, on learning this, planned a demonstration to show the

people of the community just how the proposed illumination would look. A standard 60-cp., 75-watt series tungsten lamp was hung from a corner span rigged up for the purpose, and one of the company's electric trucks was driven over to Trotwood and its batteries were connected up to the lamp. This ingenious demonstration proved so successful that the Dayton company received a 25-year franchise, a 10-year street-lighting contract, and a pumping contract.

ELECTRICALLY OPERATED GAS METER

One of the large electrical manufacturing companies is making a gas meter, based on a principle quite different from that of the ordinary meter. In this meter the gas passing through it is heated, by an electrical heating unit, through a fixed small temperature range, usually about 2 deg. Fahr., and the electrical energy required to produce the change in temperature provides a measurement of the flow of gas through the meter.

The difference in temperature of the gas, before and after it passes the heating element, is controlled and kept constant by means of two resistance-thermometer screens which are placed on opposite sides of the heating element. The electrical energy required to raise the temperature of the gas a predetermined value is directly proportional to the mass of gas flowing through the meter, regardless of its temperature, pressure or volume. The energy input to the heating element is recorded on a watt-hour meter, or any suitable watt-meter, which can be cali-

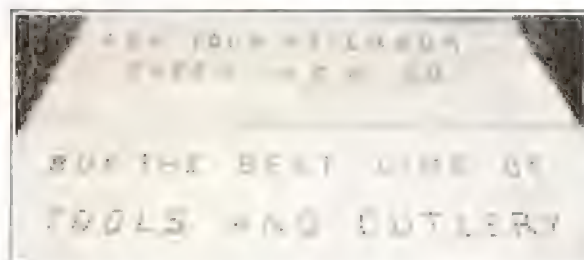


Electric Truck Feeding a Street Lamp with Current as a Means of Demonstrating Electric Street Lighting to an Ohio Community

brated directly in cubic feet of gas at a standard condition of temperature and pressure. It is found that about 1 kw. hour is required for each 75,000 cu. ft. of gas passing through the meter.

TOWN SELLS CEMENT WALK FOR ADVERTISING

Wishing to extend a cement sidewalk a distance of three or four blocks to the new fair ground, and having no fund for the purpose, the town of Hope, Arkansas, constructed the extension by selling each outlined block of it as advertising space. A plat was made of the walk, showing it divided into numbered squares. A few of the squares were retained, on which to place a short history of the town, giving names of prominent men, various industries, population at dif-



A Section of Cement Sidewalk in Hope, Arkansas, was Paid for by Selling It as Advertising Space

ferent dates, and the names of county and town officers at the time, and the remainder were sold for advertising.

In most cases the advertising was done by forming the letters in the top coat before the final set, but a few of the advertisers furnished aluminum letters and numerals, about 3 in. high. Although the sidewalk has now been laid for some time, the outlines of the letters are said to be as when first made.

LOOKING-GLASS AS RAILWAY TRACKMAN'S TOOL

A looking-glass at the end of a long handle is the simple and ingenious device by means of which the trackmen of the German electric railways examine the power cable. Before the

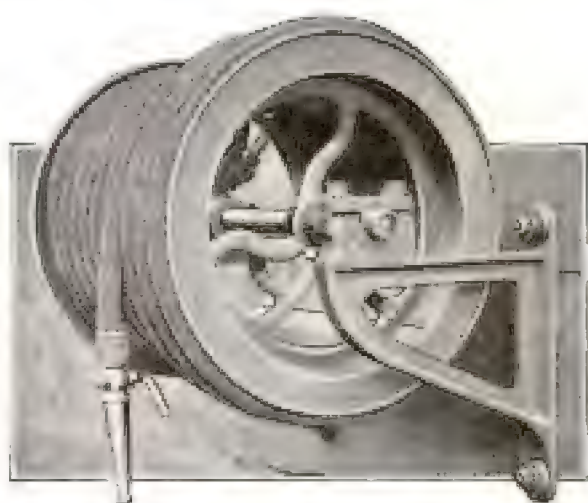


Examining the Cable of an Electric Railway in Germany by Means of a Looking Glass on a Stick

looking-glass came into use the examiners had to go down on hands and knees to peer under the guard of the cable.

INGENIOUS FIRE-HOSE REEL

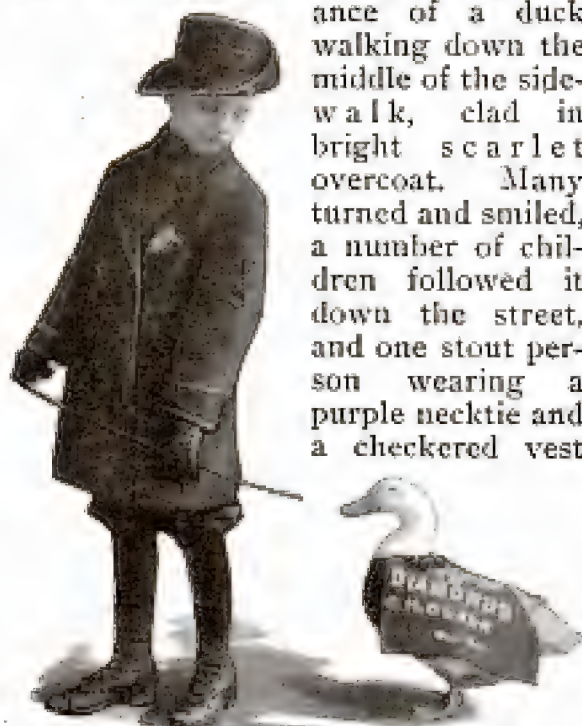
In the accompanying illustration is shown an ingenious fire-hose reel for hotels, business places of all kinds, and for homes. Its important feature is that the hose upon it is ready for immediate service without having to be entirely unwound. The water connection is at one of the bearings of the drum, the reel being constructed with a wrought-iron center having a bored waterway. The hose used is of a non-collapsible type, and there is always a clear waterway, without danger of kinks, no matter how much or little of the hose is unwound.



Any Length of Hose may be Unwound from This Reel, Water Being Supplied from Center

THE ADVERTISING DUCK

Shoppers on Broadway, Los Angeles, were amused recently by the appearance of a duck walking down the middle of the sidewalk, clad in bright scarlet overcoat. Many turned and smiled, a number of children followed it down the street, and one stout person wearing a purple necktie and a checkered vest



An Advertising Duck on a Los Angeles Street

was observed to clutch at a lamp-post, exclaiming, "Got 'em again." A duck in a scarlet overcoat is bound to attract attention, and that is what the local business man wanted when he put the little boy's pet to use by placing his advertisement on the garment. The fowl is devoted to its young master and follows him everywhere without a leading string.

RAILROAD TO BE BUILT OF PANAMA CANAL MATERIAL

Secretary of the Interior Fisher has suggested that when the Panama Canal is completed, the construction material used in that undertaking be utilized in building a railroad in Alaska from Seward to the Matanuska coal fields. There were about 375 miles of rails and ties, about 40 locomotives, and 700 flatcars used in the construction of the canal. This material will all be of no use to the government

when the canal is completed, and would no doubt be sold at a sacrifice, making ample allowance for depreciation. The cars that are used in the canal work could be converted into coal cars very easily, but the gauge of the cars and engines is 5 ft. instead of 4 ft. 8 in., which is the standard, and some difficulty might be experienced in trying to change the gauge. There is no doubt, as Secretary Fisher points out, that if the proposed road be constructed, it would open up a vast territory for development.

"HANDCUFF KING" ESCAPES FROM DIVING SUIT

When Harry Houdini, known as the "Handcuff King," was exhibiting recently in Norfolk, Va., he received a challenge from

members of the submarine flotilla at the Norfolk Navy Yard to attempt an escape from a navy deep-sea diving suit. The challenge was accepted, and men selected from the crews placed the suit on Houdini. His body was encased in the heavy, high-pressure, waterproof garment, which inclosed the entire body from the neck down to and including the feet, the copper breast and neck plate

was put on and fastened to the lower garment with bolts, the brass and steel diver's helmet was placed over his head and secured with the usual brass wing-bolts and nuts, and then his feet were chained and his hands handcuffed. He escaped in 49 minutes.



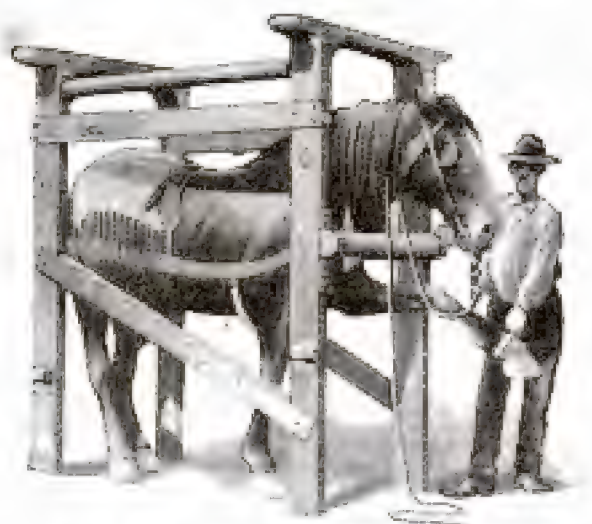
STREET OF ABUNDANCE IN ANCIENT POMPEII



Upper View, General View of the Street of Abundance of Pompeii—On Left, Twisted Body of Man Believed to Have Attempted to Save His Life by Climbing a Tree

Exterior of Pompeian Wine Shop Recently Uncovered, Showing the Counter and Vessels Used for Wines

Archaeologists have made a series of remarkable finds in the ruins of Pompeii within the last year. The most interesting discovery was the body of a man found in such a position that the scientists are convinced he was attempting to escape the rain of ashes and lava by climbing a tree when the city was destroyed 2,000 years ago. The street which has just been uncovered has been called the "Street of Abundance." A wine shop was found with many of the vessels intact and some unusual signs and frescoes were also discovered.



A Frame or Cage for Horseshoeing in Zeeland

A DUTCH HORSESHOEING CAGE

A horseshoeing scene in Zeeland, the Netherlands, is shown in the accompanying illustration. The horse is driven into a cage or frame, designed to keep the animal from breaking away or kicking during the operation.

CA California farmer works his farm 24 hours of the day, his farm hands being employed in regular eight-hour shifts, and his plows and other machinery of that sort being equipped with searchlights for use at night.

REMARKABLY PROPORTIONED GUM TREE

One of the most famous and unusual trees growing in Los Angeles is this remarkable gum tree of the lemon-scented gum variety, the foliage of which is as fragrant as that of the lemon-scented verbenia. Planted 17 years ago in the city salesyard of a Los Angeles nursery, it has grown to a height of 130 ft., has a diameter of only $11\frac{1}{4}$ in. at its base, and has a tuft of branches which begins 120 ft. from the ground. The extremely thin trunk sways as much as 50 ft. from the perpendicular in a high wind.

The illustration shows a steeplejack climbing the tree to cut off a few straggling limbs, a calm day having been chosen for the operation.

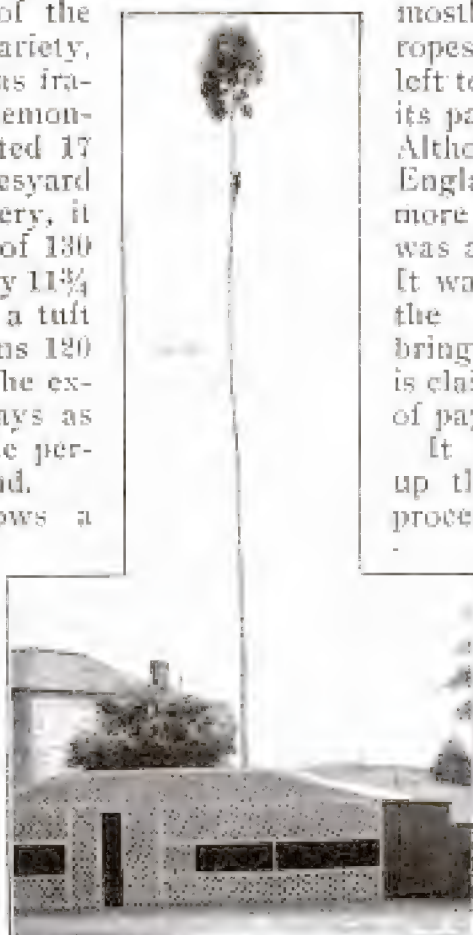
ALGERIAN GRASS FOR PAPER MAKING

In Algeria there grows today over 12,000,000 acres of a grass which is said

to be destined to greatly cheapen the production of first-class paper throughout the entire world. It is esparto grass, and has never been grown in this country. In Algeria it is used

mostly for weaving baskets, ropes, cords, etc., and it was left to the English to discover its paper-making possibilities. Although only imported into England a short time ago, more than 2,500,000 tons of it was absorbed there last year. It was used in 50 per cent of the English paper mills, bringing down the prices, it is claimed, of the finest grades of paper to one half.

It is not necessary to cut up the esparto grass in the process of converting it into paper pulp, but merely to boil the whole plant in lye for about five hours. This dissolves the balsams, resins and coloring matter, and then the fibers are removed to the washing and bleaching machines, which convert the stock into a mass ready for pulping. The expense of pulping the grass is



A Los Angeles Gum Tree 130 Feet in Height, with a Trunk but $11\frac{1}{4}$ Inches in Diameter at the Base. A Steeple-jack is Shown Climbing the Tree



A Greenhouse Erected in London to Prevent Bulbs from Blossoming before the Time Desired

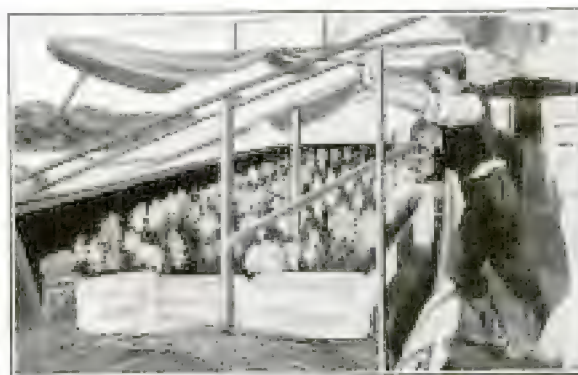
claimed to be much less than the pulping of rags, one great difference being in the chemicals. Only about 9 per cent of the lye required for rags is required for the grass. Special grades of caustic soda, absolutely free from lime, not only cheapen the cost of producing the pulp, but avoid the pollution of streams by mill refuse, and also make it possible for the paper manufacturer to use the same lye many times over again, merely by the addition of quantities of fresh caustic soda.

Two tons of raw esparto grass make one ton of pure white primary paper.

During the recent coal strike in Great Britain coal was selling at \$2,150,400 a ton. Certain wise jewelers of London conceived the idea of selling "Black Diamonds." The mineral was nipped into shape, polished and mounted as tie-pins. Thousands of these black diamond tie-pins were purchased as mementos of the great coal strike.

A GREENHOUSE WHICH RETARDS GROWTH

A Dutch landscape gardener in London who received quantities of Dutch bulbs for use in the gardens of the Dutch village, which was part of the Ideal Home Exhibition held recently at Olympia, constructed a greenhouse the purpose of which was to retard growth instead of to hasten it. This curious greenhouse was constructed of canvas instead of glass, and blocks of ice were laid all around the bulbs, so that the budding flowers would not blossom too quickly.



Cakes of Ice Placed Around Budding Flowers

NEW GERMAN TYPE OF AUTOMOBILE BODY

A new streamline automobile body of German make, providing an exceptionally smooth blending of hood and dash in its lines, which is a marked contrast to the abrupt angles and projections of the usual automobile body, is shown in the accompanying illustration. Other features are the placing of the steering wheel and the driver's seat in the center, where the driver's body will not prevent a clear view of the road ahead from the rear seats; and the deeply upholstered arm chairs substituted for the usual single wide seat. The two auxiliary seats in the passenger section of the machine are also of the arm-chair variety, and are arranged to swivel in order to facilitate entrance and exit. The single seat located centrally in the driver's compartment seems logical, as the extra seat beside the driver is seldom occupied by a passenger in a limousine type of car.

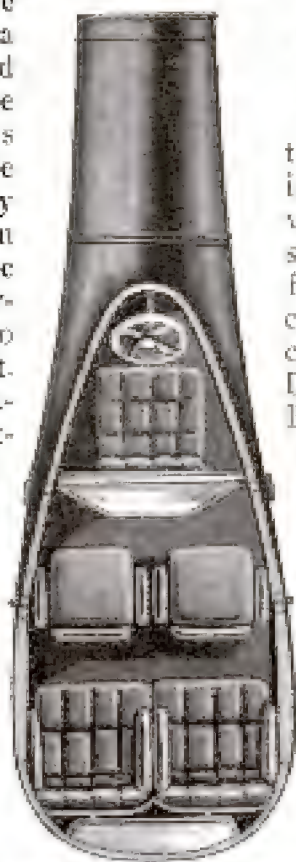
EFFECT OF PAINT ON CORROSION OF IRON

According to the rather surprising results obtained by two German chemists, M. Liebreich and L. Spitzer, of Berlin, who were experimenting with paint as a preventive of the corrosion of iron, it seems that one coat of good paint or varnish is much superior to two or more coats. In their experiments a second or third coat proved absolutely detrimental.

The experiments consisted in painting well polished steel bars with one or more coats and suspending the bars over boiling water for four days. Half of the coating was then removed and the bared metal well covered with vaseline to prevent oxidation. In each case where only one coat of paint

had been applied the bars remained as brilliant and rust-free as before the test, but in the case of two or more coats, corrosion had taken place.

The investigators would not commit themselves as to the explanation of this, but the French scientific magazine *La Nature* suggests it may be that a coating of several layers provides a less flexible cover, more liable to crack, thus allowing oxidizing agents to penetrate to the metal surface.



New German Model Having Interesting Lines, and a Single, Centrally Located Seat in the Driver's Compartment

AEROPLANES SUFFER STRAIN FROM ABOVE

Until Lieutenant Sevelle fell to his death recently in France it was not admitted that the wings of aeroplanes could be subjected to breaking strain from above, but this proved conclusively that such is the case. It has, according to Louis Bleriot, in *L'Aero*, Paris, explained a whole series of hitherto not well understood accidents, including those in which Chavez, then Blanchard, Lantheaume and Ducourneau lost their lives. Witnesses of the Chavez accident did say that the wings of his machine had broken and dropped downward, but this was thought to be a mistake or an optical illusion. However, this accident led constructors to strengthen the wings, and the strengthening was still more increased after the subsequent accidents to Blanchard and Lantheaume. But it was in a machine with the latest type of reinforced wings that Sevelle made his fatal flight, and all four upper guy wires were found broken as if cut by shears.

All the accidents referred to occurred under similar conditions and naturally led to the suggestion that the wings were submitted to forces from above, which they were not equipped to withstand. There is no

room for doubt that the accidents were caused by the breaking of the upper wires, and not, as was hitherto assumed, to the breaking of wings which had successfully withstood resistance tests from below.

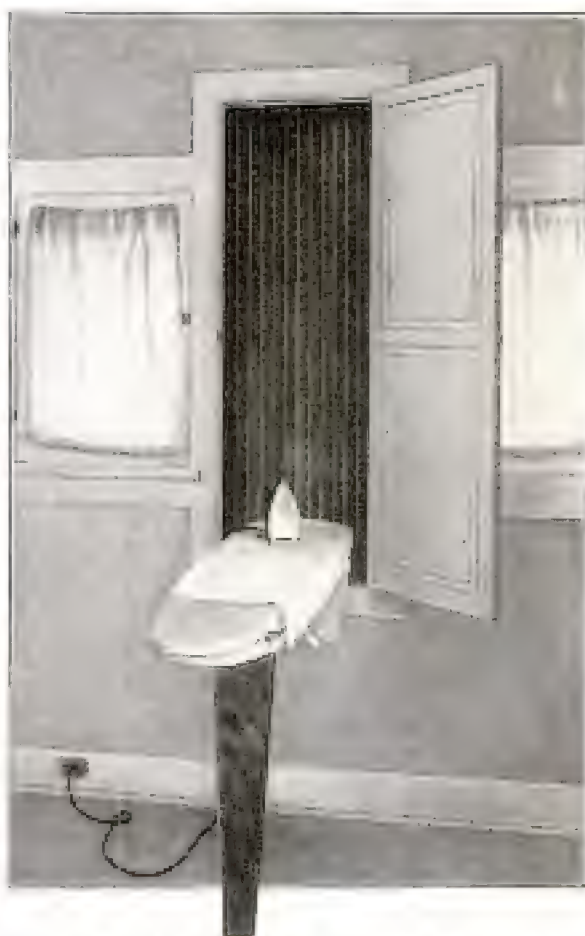
"It would seem necessary, therefore," says Louis Bleriot, "also to test the resistance of wings against strains from above, in order to obtain upper wiring of sufficient strength. The relation between the strengths of the upper and under wiring should, in my estimation, be about as 3:5. However, as the inertia of an aeroplane is increased as the square of its speed, if one assumes a coefficient of safety of 5 as sufficient for a machine flying at 60 miles an hour, this coefficient should be increased to 20 in an apparatus flying with twice that speed.

"It must also be considered," says Bleriot, "whether the airman's body can resist the shocks that will be the consequence of such coefficients. I believe that the body of a seated man could not sustain a shock from above of more than twice his own weight without being thrown out of his seat, nor that it could resist a shock in the opposite direction of more than that corresponding to a coefficient of 5 or 6, without having his internal organs dangerously displaced. There is, therefore, no reason to insist on exaggerated values of these coefficients of safety. Their values must always be limited by the resistance of the airman's body."

"From the further study of these conditions," he concludes, "much should result that will tend to increase the safety in flight."

BUILT-IN IRONING BOARD

In the accompanying illustration is shown one end of the kitchen of a bungalow in Los Angeles, Cal., one of the kitchen-cabinet features of which is an ironing board that folds up into a cabinet in the wall. When the ironing is finished, all that is necessary is to push the board upward, the inner end being hinged to the bottom board



The Cabinet-Kitchen of a Los Angeles Bungalow with a Special Cabinet for the Ironing Board

of the cabinet. The leg naturally folds up against the board. The electric iron may be quickly detached from the wall socket and placed in the cabinet with the board. The arrangement of the numerous cupboards, drawers and cabinets of this kitchen is also interesting.

DETECTING THUNDER STORMS BY WIRELESS

By means of a modified wireless set recently installed in the observatory in Lyons, France, M. Flajolet has been able to note atmospheric electrical disturbances at a long distance. In some instances thunder storms have been detected when more than 300 miles away. A mineral detector is used in the set instead of an electrolytic detector, as the latter was found to be unsatisfactory for this kind of work, in which it had to be in circuit continuously and would get out of order.



TRANSFORMING THE PANAMA DREAM INTO A REALITY

The latest photographs of the Panama Canal show how closely the engineers have gauged their ability in promising the completion of the big ditch by next year. This picture of one of the Gatun Locks was made a few weeks ago, and there seems to be little more to be done to it beyond removing the scaffolding and other construction aids, and material. This particular point along the canal will be one of the busiest on the Isthmus when the canal is finished. Ninety-eight electric motors will be in operation twice during each lockage at the Gatun Locks, in raising a ship through a vertical distance of 85 ft. from the sea level to the level of the lake. These motors are used in lowering fender chafes, opening and closing six pairs of gate valves, 30 cylindrical valves, and six pairs of gates.

AEROPLANE BOMB TESTS WITH REAL BOMBS

A program of events of practically every aviation meet in this country and abroad in the past year or two has included bomb-dropping competi-



The Aero-Target Used in the Bomb-Dropping Test for the Michelin Prize



The Bomb-Proof Viewing Shelter Erected for the Judges



The Judges Watching the Competition through a Long Narrow Slit in the Wooden Portion of the Shelter

tions, but the bombs have usually been imitations instead of real explosives. In the recent bomb-dropping test in France, for the Michelin prize, real explosives were used, and the method of protecting the judges is interesting. The aero-target was of concrete, about 32 ft. in diameter, and near it was erected a bomb-proof viewing shelter for the judges. The judges watched the competition through a long narrow slit in the wooden portion of the shelter.

FLOWER-VASE CENSER

Seemingly a vase with an imitation flower in it, this Parisian novelty is in reality a censer in which a deodorizing fluid is burned, together with a special perfume representing the odor of the particular imitation flower which is used to form the top. It is made in a variety of styles and shapes.



ⓈThe new British battleships "Centurion" and "King George V" are to be fitted with anti-rolling tanks, these being the first warships to be so equipped.

'SANDALS GIVEN WITH EVERY TICKET

Loggers and woodsmen, wearing their heavy calked boots as they come out of the Puget Sound forests, have played havoc with the expensive car-



Steamship Company Provides Its Woodsmen Passengers with Sandals While on Board Ship

pets, hardwood floors and tiling aboard Sound steamers, many of which are very handsomely fitted for passenger traffic, and carry thousands of tourists during the summer months. The sharp calks on the loggers' boots cut the carpets to rags, gouge the floors and ruin the tiling.

One company, which controls much of the steamboat business on the Sound, is trying to solve the problem by the introduction of "loggers' sandals." For a long time loggers have been refused passage unless they would remove the calked boots, but as many of the men were just out of the woods and had no other boots or slippers to wear, this worked a hardship. The general manager of the transpor-

tation line invented the sandal, which is simply a thin wooden sole with tape ties. It can be quickly tied beneath the sole of the heavy boot, and the passenger can clump about with some degree of comfort.

Ticket agents are being supplied with stacks of the sandals. As they sell a ticket they scrutinize the passenger's boots, and if he wears the high-topped calked boot of the logging camps, he is handed a pair of sandals with his ticket. The immediate cause for the introduction of the sandals is that the company's boats have recently been refitted with carpets, and the floors varnished and repaired; and the owners did not care to take any chances of continuous damage.

PAWNSHOPS IN CHINA

Pawnshops, in China are of great antiquity, possibly antedating the Christian era. As a rule they are quite similar in appearance, in the country districts being almost invariably in the form of a square tower about four stories high. They are the most prominent objects in the landscape, looming up like the churches in the French Canadian hamlets of Quebec. A distinguishing feature is the lack of

windows, particularly on the lower floors, so as to offer as little opportunity as possible for forcing an entrance. It frequently happens in the country, after a bad harvest, that the people are on the verge of a famine, and after having pledged everything they possess that is pawnable, they storm the pawnbroker in his citadel.

Through experience the broker has learned to take precautions against a sudden attack or siege so that as soon as danger threatens, he barricades himself within, and all business, henceforth, is carried on from the roof or one of the uppermost windows by means of a basket lowered by a string. If the needy should actually be dying of starvation, custom prescribes that the pawnbroker must come to their assistance—experience probably having taught him, in the course of ages, that, were his clientele to die off he would have to go out of business.

The illustration shows a shop on one of the principal thoroughfares of Shanghai. As the city is under foreign control and efficiently policed, an ample doorway facing the street has been provided. This building is not as high as those in the country and lacks the small windows in the upper floors, probably for the reason that there are no quarters. The doorway can be efficiently barricaded at a moment's notice; but over and above this, further precaution is taken. The interior is fenced off by a heavy wooden grill, just back of which rises a structure not unlike a judge's bench, but higher. At this sits a clerk with several assistants to whom the client must pass up his pledge for examination.

The bookkeeping is so well systematized that even in case a ticket is lost, the full particulars concerning the pledge can be at once determined. The rate of interest varies, but for small loans is usually about one per cent a month. Foreigners frequently pawn their furs for safe keeping during the summer months. Excellent care is taken of them at very nominal expense as the loan may be almost as small as desired.



The Individual Architectural Characteristics of Chinese Pawnshops

ACTUAL USE OF DIRIGIBLES IN TURKO-ITALIAN WAR



One of the Italian Dirigibles Ready for a Flight over the Turkish Lines

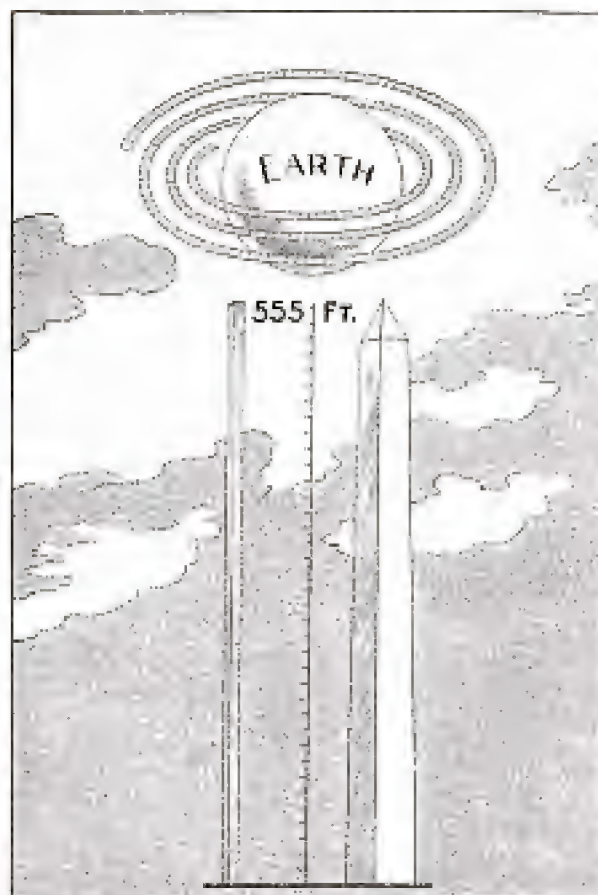


An Italian Dirigible Returning after an Aerial Bombardment of One of the Enemy's Camps

Illustrations have been previously published in this magazine showing how Italy is utilizing aeroplanes for actual service in the war with Turkey. She is also the first country to demonstrate the possibilities of the dirigible in war, and is now using a number of them. Two of Italy's military dirigibles made recent flights over the enemy's encampment at Zavia, dropping 25 bombs from a height of 2,000 ft., causing slaughter and confusion.

THE TROUBLES OF THE PATENT OFFICE

From basement to attic, in rooms and galleries, along corridors and under the steps of the Patent Office build-



Patent Documents on File in U. S. Patent Office would Stretch Three Times around the World, or would Form a Mass 15 Feet Square, as High as Washington Monument

ing, the storage of patent documents has continued until there are now over two miles of cases, nine shelves high. If all the copies of patents stored in the building were laid end to end, they would form a strip 75,000 miles long, which would reach three times around the earth. Placed in a pile, they would form a mass 15 ft. square and as high as the Washington monument, and, if placed on one continuous shelf, a shelf 19 miles long would be required.

The quantity of the material, however, is not the only feature that troubles the department. The dust accumulates faster than it can be cleaned off, and the great quantity of paper and wooden shelves makes the danger of a disastrous fire always imminent.

An average of 800 patents are granted each week. An estimate of \$220,000 has been submitted to Congress for an appropriation for the construction of an additional wing.

LOADED CARS LIFTED BODILY BY ELECTRIC HOIST

The freight cars carrying material to be used in the construction of the approaches to the new St. Louis municipal bridge across the Mississippi River, were lifted by means of powerful electric hoists, load and all, from the main track to the level of the approach, 112 ft. above, and a switch engine then pushed them to the point where they were to be unloaded. Ordinary flatcars were handled in this way, their trucks being chained to the car-body before they were raised from the lower tracks. The weight of the car and its load often exceeded 75 tons. The object of handling the cars in this manner was to save time, the cars being deposited at the point where they could be unloaded a piece at a time, and the necessity of handling the load twice thus eliminated.

CONVERTING FLYWHEEL INTO FAN

At least one concern in the automobile industry is making an attempt to do away with the regulation fan for cooling the engine. They fit the fly-wheel with peripheral blades, thus cooling the engine direct from the fly-wheel.



China's first trial by jury took place in Shanghai, March 25 of this year, under a new code of laws prepared by Dr. Wu Ting Fang, Minister to the United States of the Chinese Republic.



MONTE CARLO FROM A HYDRO-AEROPLANE

The Bay of Monaco has been the scene of the first hydro-aeroplane meet held in the world, and eight types of the air-and-water vehicle were displayed. During the course of the meeting a number of photographs were made from the machines while in flight, this one being one of the clearest and best as it gives an excellent view of the far-famed Casino and at the same time shows something of the surrounding buildings and parks. The Henri Farman type of hydro-aeroplane was considered by the judges the best shown. Maurice Farman's entry was second. Both are biplanes.

PHOTOMICROGRAPHS AS ART PATTERNS

As illustrative of the German tendency to utilize scientific progress in commercial production the accompanying illustrations are of special in-

terest. They represent photomicrographs of crystallization forms of chemical solutions as seen under the microscope. They are taken from a



This Photomicrograph of a Chemical Solution Provides a Beautiful Design for Cut Glass



Design That Would be Fine in Colors for a Vase

recent German work which is published for the sole purpose of furnishing new pattern and ornamentation designs for various arts and crafts.

Imagine for instance the beauty of a cut-glass dish in the pattern shown in one of the illustrations, and of the

other, for instance, in colors in a majolica vase. The designs thus obtained by photographing a drop of chemical under the microscope are just as available for designs in wallpaper, metal work, pressed leather, glass painting, textiles, etc.

MOTORBOAT WRECKED IN A CITY STREET

During a motorboat exhibition recently in Montreal, Canada, a truck which was transporting a 40-ft. raised-cabin cruiser collapsed and the boat



A Motorboat Stranded in a Montreal Street by the Collapse of a Wagon Axle

was pitched onto its side, half on the pavement and half on the sidewalk. The only apparent damage was some broken china and glassware in the cabin, and a scratching and rubbing which required nothing more than a new coat of paint on one side.

¶ Though Philadelphia is noted as being a city of sober, abstemious people, the city directory just printed shows the names of a number of citizens that belie this reputation, as there are 8 Drinkhouses, 275 Bars, 9 Rummerns, 7 Drinkers, 1 Drunk, 10 Drinkwaters, 9 Wets, 1 Dry, 5 Brews, 20 Beers, 9 Wines, 1 Gin, 255 Steins and 53 Seidels represented in the long list.

NEW USES FOR TUNGSTEN AND MOLYBDENUM

There were only two practical applications of the two metals tungsten and molybdenum previous to their production in a ductile form: in steel making, and in electric lamps, the tungsten being used for filaments and the molybdenum for filament supports. The drawn tungsten filament, being of greater strength, however, almost entirely replaced the earlier forms.

The electric furnace wound with tungsten or molybdenum wire has been found superior to the furnace wound with platinum wire, both because of the higher temperatures and quicker heating attained, and because these metals are cheaper than platinum. They both serve as good

substitutes for such metals as platinum, platinum-iridium and iridium, in make-and-break devices for electric circuits.

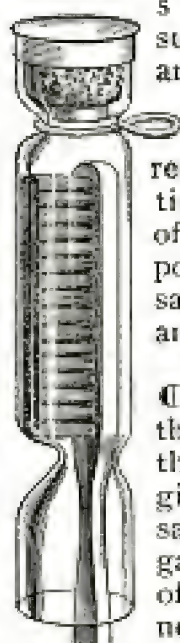
On account of its higher melting point, as compared with platinum, tungsten affords an almost indestructible target, upon which the cathode rays in the Röntgen tube may be more closely focused, which will result in a sharper definition and shorter exposure.

Careful consideration is being given at the present time to the possibility of using wrought tungsten for projectiles. It has a high specific gravity which will give it a longer range, and its hardness and great tensile strength should give it a better penetrating power than the

materials now used. It is suggested, however, that the small tungsten bullet of the same weight as the ones now in use would have the disadvantage of not producing as disastrous results to the victim, unless it should hit a vital spot.

SANITARY TOOTHBRUSH HOLDER

This sanitary toothbrush holder, which is of European origin, consists simply of a glass tube of sufficient diameter to admit an ordinary toothbrush, the upper end of the tube terminating in a cup-shaped receptacle containing an antiseptic tablet which gives off microbe-destroying vapors, or a wad of cotton kept saturated with some kind of antiseptic liquid.

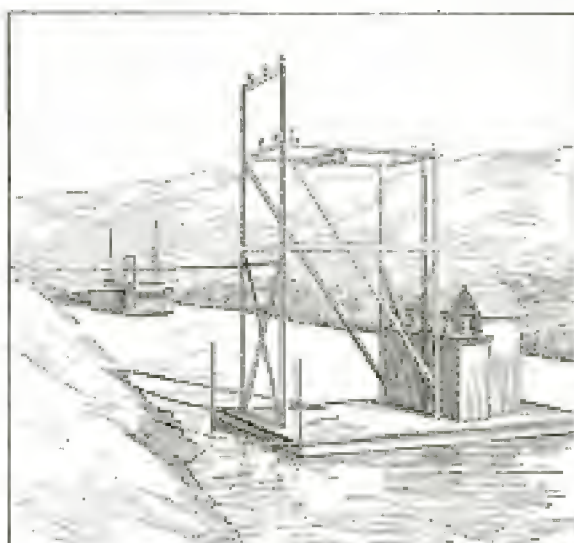


¶An English electrical authority announces that while the cost of cooking to a given degree would be the same with electricity as with gas, in order to obtain 12 lb. of cooked meat it would be necessary to put 17 lb. 2 oz. into the oven of a gas stove, while but 13 lb. 10 oz. would be required by an electric oven, the difference being the amount of moisture, etc., that would be extracted from the meat in the process of cooking.

TRANSFORMERS PLACED ON A FLOAT

An interesting installation of outdoor transformers used in the construction of the Los Angeles aqueduct, is shown in the accompanying illustration. The transformers were placed on a float and were towed from place to place as the work progressed, connection being made to an adjacent high-tension line. The high voltage was stepped down by these transformers for use on an electrically operated dredge.

The outdoor type of transformer is

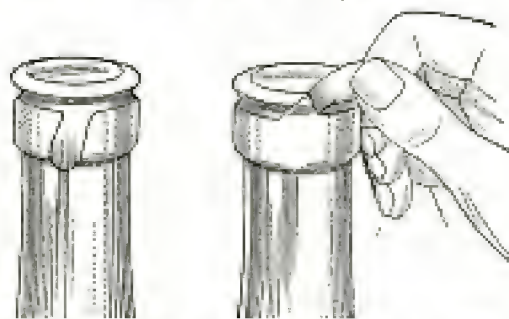


These Transformers, Placed on a Float, Stepped the Voltage of a High-Tension Line for the Operation of an Electric Dredge

a comparatively recent development in the electrical field, its special purpose being to distribute electric power from high-voltage lines for use in industrial plants and small towns where the small amount of power sold would not make the installation of a regular substation economically feasible.

NEW BOTTLE CAP

A French concern is manufacturing a new type of bottle cap or stopper, the feature of which is the ease with which it may be removed from the bottle. The metal cap in general use on beer bottles, and the like, in America requires some kind of opener for re-



Tab Affords Means of Readily Removing Metal Bottle Cap

moval, but this cap is provided with a metal tab which, when lightly pulled in the fingers, tears the rim of the cap off.



The Cowed "Monk's Head" of Cooney Canyon,
New Mexico

NATURE AS A SCULPTOR

Almost every western state has one or more natural statues; some are carved so perfectly by the action of the elements as to be startling in their expressions. One of the

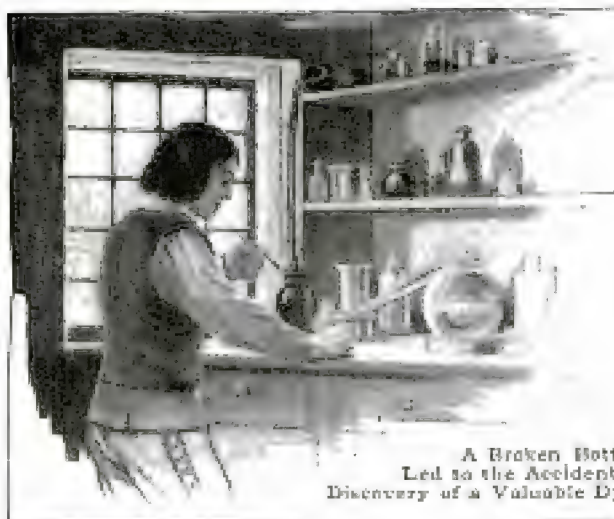
most striking is the "Monk's Head," in Cooney Canyon, New Mexico, a freak of nature which brings out in clear relief a man's face, the head appearing to be hooded. The figure is of giant proportions and at a distance, sharply outlined against the sky, it seems impossible that it is not the work of some ancient people who may have wrought upon it with crude tools, yet obtaining a singularly strong and virile expression of countenance.

LARGEST TOURING AUTOMOBILE

The automobile recently delivered by a French company to the chief inspector of the finances of France is claimed to be the biggest touring car ever turned out. It is a six-cylinder model developing 160 hp., and has a wheel base of 198 in. It has an eight-passenger limousine body, the rear wheels are fitted with twin tires, and its lighting equipment includes electric head and side lamps and a powerful acetylene searchlight pivotally mounted on the dashboard.



Exceptionally Large Touring Automobile Used by the Chief Inspector of French Finances



A Broken Bottle
Led to the Accidental
Discovery of a Valuable Dye

Great Discoveries

Due to

Happy Accidents

By

G. E. CHAMBERLAIN

IT IS repetitive history that many a person who has spent hours upon hours combining and recombining the factors of his problem, has had the solution thrust upon his attention by some casualty of daily life. Such occurrences are the spice of research and lead on many a weary investigator in hard and exacting labor. Here is the field where the trained observer has all the advantage. For how many fortunes may never have been realized only because no one had eyes to behold the revelation?

In our own time every beet-sugar factory was confronted with these two problems: How most cheaply to move the beets from the storage sheds to the slicers; and how to cleanse the beets from the dirt, small stones, and rubbish carried from the earth silos. A German factory happened to have a considerable quantity of beets piled alongside an open drain. A very heavy rainstorm came on, and when it was over, it was found that the beets had not only been carried to the very door of the factory, but were cleaned as well. From that time on every factory has flushed its beets from storage to plant and saved money by combining the two operations of transportation and washing.

Thomas Kingsford discovered the process of making starch from Indian corn by chance. Starch could be made from potatoes and from wheat, but it had always been found impossible to separate cornstarch from the accom-

panying gluten. The wheat-starch methods did not answer. Kingsford was a mechanic working long hours, and all his experiments were made in his own kitchen with his wife's pans, tubs, and buckets as his laboratory utensils.

The unsatisfactory result of one of his experiments—a mush of cornmeal and water—he disgustingly threw into a garbage tub. A little later his wife threw into the same tub some lye wastes. Upon emptying the tub the next day, Kingsford was surprised to find a small amount of fairly pure starch at the bottom. His wife fortunately remembered throwing in the lye, and thus the basic principle was discovered.

Kingsford soon worked out a practical process for making cornstarch commercially, and he not only made a great fortune for himself and his descendants, but laid the foundations of an industry which consumes 30,000,000 bu. of corn annually in the United States alone.

In 1742, Thomas Bolsover, a mechanic of Sheffield, Eng., discovered the art of silverplating. He was repairing the handle of a knife in which both copper and silver were used. Accidentally the two metals were fused together. Based upon this observation he developed the new process. Upon a thick ingot of copper he bound by iron wire a thinner ingot of silver. The whole was then heated in a reverberatory furnace until the edges of the silver ingot were observed to begin to



Kingsford Discovered How to Make Cornstarch When His Wife Threw Lye into a Garbage Pail

melt. The two ingots were then removed from the furnace, slowly cooled and pickled, cleaned and rolled to the desired thickness. The result was a plate of copper more or less thinly covered with silver on one side. This was the first Sheffield plate. For 50 years following, the copper was plated on one side only, and the cut edges showed the copper. Later, the process was so perfected that no copper was left exposed. All the silverplate of the world was made by this process, until electroplating was discovered and made commercial.

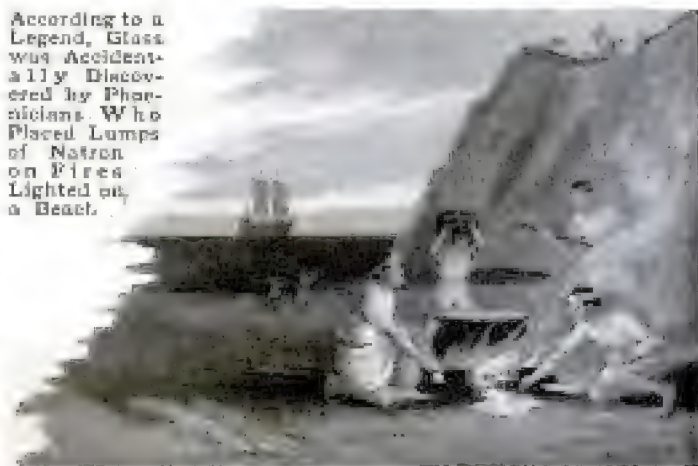
The many technical processes of the ancients were without doubt of accidental origin. Until comparatively recent times there was no groundwork of theory in either metallurgy or chemistry, and intelligent investigation, planned to accomplish a certain result, cannot exist without this groundwork. The only opportunity for technical progress was that afforded by chance in conjunction with a keen and inquiring observer. For instance, the Romans knew nothing

of the metal zinc. But some observing Roman mechanic had found that when stones of a certain kind were heated with copper, a hard, yellow metal was obtained. Thus brass was discovered and in this manner it was made for centuries. We know now that the stones which possessed these curious properties were the minerals calamine and smithsonite, the silicate and carbonate of zinc respectively. They occurred together in mines, which were, at that time, worked for the iron ores.

Vitruvius is our authority for the statement that the manufacture of red lead was the result of an accidental fire. He also tells us that red lead made by calcining white lead in a furnace was much superior to that obtained directly from the mines.

This is similar, in a way, to the legendary story of the discovery of glass by the Phœnicians. The tale runs in this way: Certain of their merchants, returning from Africa in a ship loaded with natron (crude mineral soda ash), found it necessary on account of bad weather to seek harbor. They found themselves on a sandy plain near Mount Carmel. They built fires on the sand and placed their kettles over the fires on lumps of natron. The heat fused the sand and natron together, forming the first glass. Whether or not the story be true in its details as handed down, the essence of it is certain, viz., that glass was discovered in this manner, probably at different times by men of different na-

According to a Legend, Glass was Accidentally Discovered by Phœnicians Who Placed Lumps of Natron on Fires Lighted on a Beach.



tionalities, as its manufacture was known by many people at an early period.

Vitruvius again tells us that in Spain were found certain stones which, after having been "punished" (beaten) with iron rods, for a sufficient length of time, began to "perspire," and the "perspiration" was mercury. Certainly, it was a crude manner of reducing the mercuric ore, cinabar, with metallic iron, but surely feasible.

He fails to tell, and one cannot but wonder, by what happy accident this method was discovered. Could it be that hammering stone was an official punishment then as it is now?

In setting, or mordanting certain dyes, the salts of tin are indispensable. The origin of their use is but little known. Cornelius Drebbel, about the year 1610, was doing some work with cochineal. On a shelf overhead was a bottle of aqua regia, a mixture of nitric and muriatic acids. This bottle was broken and the acid trickled down a window frame and part of it ran into another bottle containing an extract of cochineal. A brilliant scarlet resulted. Drebbel later attempted to repeat the experiment by adding aqua regia to extract of cochineal but there was no change of color. After very careful study, he noticed that a part of the window frame down which the acid first ran was covered with tin. It appeared that tin was the active element, and further experiment confirmed this conclusion. As a result Drebbel owned the secret of making a dye having many new and valuable qualities, and today this is an important use of tin.



The Discovery of That Wonderful Aid to Science, the X-Ray, Was Due to a Fortunate Accident

Roentgen was not looking for X-rays but, after an experiment on an entirely different subject, he noticed that some photographic plates, which had been left near by, were fogged. He sought the reason and his great X-ray discovery was the result.

In 1884, Dr. Reusen was conducting an extensive research into a certain family of coal-tar derivatives. One of his students was a German, named Fahlberg. This

young man, one evening after returning to his boarding house, ate his dinner without having washed his hands. During the course of the meal in some manner he became aware that he had some extremely sweet substance on his fingers. He at once returned to the laboratory and tasted of every solution there. In a certain beaker he found the source of that sweetness.

He gave the new substance a commercial nickname, saccharin, and it was a wise action because its real name was "orthobenzosulphonimide." Whether the fortune he made was due to a lucky accident or his boarding-house training, remains a moot point among his contemporaries. It is also curious to note, in this connection, that after more than 25 years of general use by diabetic sufferers as a harmless substitute for sugar, this substance has recently been put under the ban by the Chemistry Bureau of the agricultural department. It is now forbidden not only to the sick, who consumed great quantities of it, but to the well who have unknowingly eaten their share under the guise of table syrups.

The pages of science are replete with similar instances, and that is one of the reasons why the hard and dreary outlines of technical research are softened and rendered alluring:

The chance of the great discovery, the possibility of great fortune or renown, the glamour, the enticing glamour that leads the student digging deep for nature's secrets ever on and on.

PECULIAR SANDSTONE FORMATION

In the region of the Black Buttes of Wyoming is found a large stretch of most peculiar sandstone formation.



Sandstone Formation Resembles Sand Blown into Ripples by the Wind

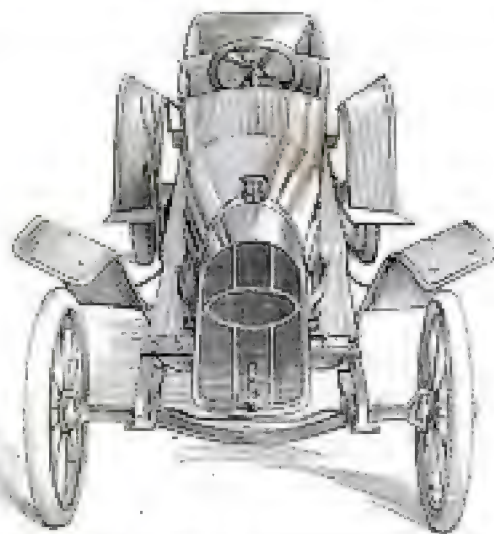
Approaching it, the traveler assumes it to be, of course, sand, blown into ripple marks by the wind. It was, in truth, so formed by the wind, but many thousands of years ago, for it is hard sandstone. So deep and clearly cut are the ridges and trenches that it seems as though the stone must have been artificially chiseled by some human machinery.

It is in such sandstone formations that the fossil bones of many species of antediluvian animals are found, sometimes almost perfectly preserved. In very many parts of the world—the Old World, as well as America—the sandstone has proven a most efficient preserver of fossils and also of the

tracks of the various creatures which roamed the earth before the first human beings, or were contemporaneous with the early cave man with his crude club or stone axe.

SPECIAL COURIER AUTOS FOR GERMAN ARMY

One of the latest types of military automobiles developed in Germany is a light car especially designed for the use of couriers in carrying dispatches. The engine develops 16 hp., which is sufficient to drive the little car at a high speed. The rather high wheels, wide wheel base, etc., compared with the size of the body, were adopted



A Light German Military Automobile Designed Especially for Army Couriers

through consideration of the fact that such cars would have to do much work in difficult roadless country.

¶An American actress, who is working her way around the world on a wager, states she found it harder to obtain employment in London, Eng., than in any other city she visited.

PREHISTORIC DINOSAURS FOUND IN UTAH

By HARTLEY M. PHELPS

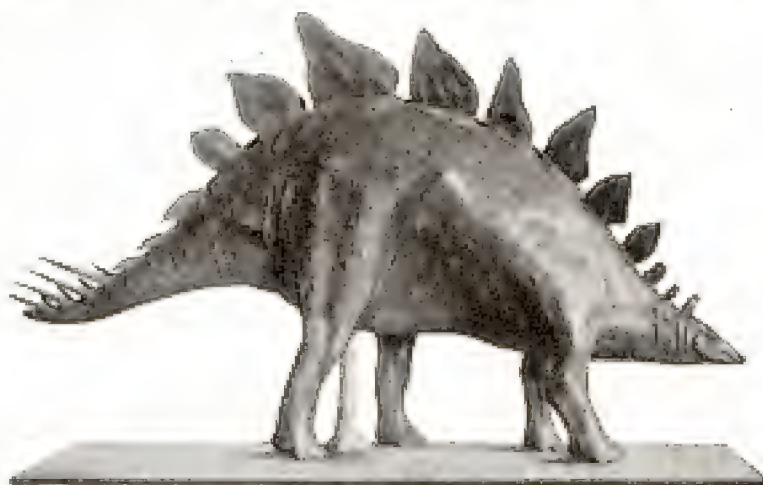
What is believed by paleontologists to be an important find of hitherto undiscovered species and genera of prehistoric land reptiles has been made by a research party sent out by the Carnegie Museum of Pittsburg, Pa. Twelve fossils or skeletons of dinosaurs, among them two complete brontosaurus—the largest animals that have ever lived—were unearthed from the side of a cliff nine miles north of Jansen, Utah, in what was, in distant ages, a river; as the cobbles, mussel shells and sand environing the bones showed. Besides these specimens of the extinct brontosaurus fossil, remains of several stegosaurus specimens were also brought to light. These are very rare. The stegosaurus was the most grotesque animal that ever existed.

Incomplete remains of a giant diplodocus, like the famous one in the Carnegie Museum, were found with the foregoing.

The research party was in charge of Earl Douglass of the museum staff, one of the men attached to the paleontological department. The party has been in the field for a considerable time, but it is decidedly slow work excavating fossils, as the greatest care must be exercised lest the rocks in which the remains are imbedded be cracked or injured. Then, when the fossils are cut away, there is an immense amount of tedious labor cleaning and assembling them. After that they must be carefully compared with existing specimens to determine whether they form a new genus or species. For these reasons scientists do not know absolutely whether the fossils discovered by the Carnegie Museum men represent hitherto undiscovered specimens. When the

rocks bearing the find arrive in Pittsburg this question will be determined.

The skeletons of the strange monsters belong to what are known as sauropoda dinosauria. Sauropoda is a suborder of the herbivorous dinosaurs or land reptiles. At first these sauropoda were carnivorous, that is, flesh-eating animals, but later became herbi-



Model of Stegosaur, Most Grotesque Animal That Ever Lived. Remains of Some of These Great Reptiles Have Just Been Unearthed in Utah.

vorous or herb-eating. The stegosaurus or stegosaurus unguatus (the unguata being hoof-footed animals) is always found in Wyoming, in the rocks of certain geological periods. It was a terrestrial reptile, frequenting the huge luxuriant forests prevalent in those days of four million years ago; and browsed on tender vegetation, of which the forests were full.

Its most remarkable feature is the double line of large bones sticking up on the middle line of its back; and with which it defended itself against its ferocious carnivorous enemies like the allosaurus. Its tail was armed with spike-like projections with which it impaled its assailants. It fought by presenting its tail and back to its foes, cutting and slashing with those terrible leaf-like bones on its back and those bony daggers in its tail. Scientists say it was a migrant from Europe.

The brontosaurus often attained a length of 80 ft.; but it had a small

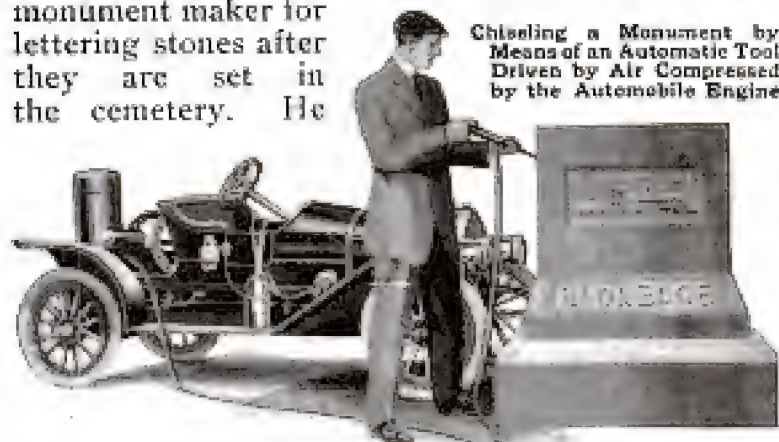
head. Its neck and tail were short. Like the stegosaurus, it lived by eating succulent herbs. It had powerful legs, 10 ft. or so in length.

The diplodocus specimen in the Carnegie Museum is the only complete one ever found and has attracted world-wide attention. Replicas of it

have been presented to half a dozen nations. The diplodocus measured 70 ft. long, had an immense body, powerful legs, and an enormously long tail, and long neck, but a small head. It lived in swamps and ate waterweeds. Its remains have only been found on the slopes of the Rocky Mountains.

AUTO FURNISHES POWER FOR PNEUMATIC TOOL

The accompanying illustration shows an improvised, portable pneumatic granite-cutting plant devised by a monument maker for lettering stones after they are set in the cemetery. He



mounted an air compressor on the back of his auto and connected it with the engine of his machine which furnishes ample power for operating the carving tool. Because of rough treatment given memorial stones in shipment, the inventor thought it a better idea to letter or inscribe the memorial after it was placed in the cemetery.

"AUTOMOBILE" IN SIAMESE

¶The Siamese word for automobile when printed in the form of a sign has all the appearance of an ad for the black art or some other such mystic performance. The sign usually is:

รถ ยนต์

THE UTILIZATION OF IRON FILINGS AND SHAVINGS

The iron sweepings from shop floors, not long ago allowed to go to waste, are responsible for a new industry in Germany, represented by about a dozen plants, which has for its sole purpose the shaping of iron filings, shavings, etc., into briquettes. The briquettes go back to the furnaces to be converted again into commercial forms of iron.

Nearly all the plants of the steel industry in Germany send the sweepings from the shop floors to the briquetting plants, and the consignments from the various concerns are kept as carefully separate as the assayer of gold and silver keeps the sweepings and filings from manufacturing jewelers.

The sweepings are first passed through a strong draft of air, which frees them from dust, including much of the graphite particles contained in cast-iron shavings. Then the sweepings go to the magnetic separator, where brass and bronze particles, as well as the heavier dirt, are removed. After these two cleaning processes, the material arrives at the hopper above the briquetting press, flows down into the empty forms, and is pressed into bricks, which are carried to the loading wagons by a belt conveyor.

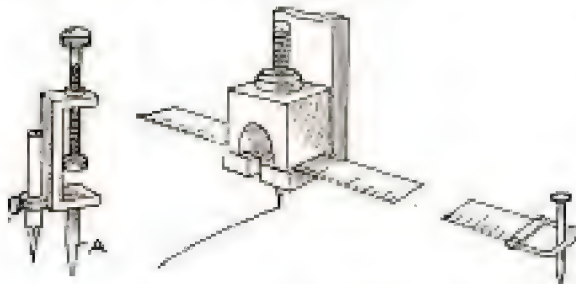
¶All horse-drawn carriages used in Burma, India, are equipped with rubber tires and have bells operated by the driver's foot to give warning of approach.



Drawing Circles of Large Diameters

The shop carpenter frequently has occasion to draw curves having a long radius, such as a form for a street-paving crown. These are usually drawn by the use of poles, but on a long radius it is not easy to fasten the poles together to get the length. To do away with the need of a pole, I use the attachment taken from a trammel on a steel tape as shown in the sketch.

The steel point of the trammel A was removed and a V-shaped notch filed in the front part. A small wood



Trammel-Point Part and Manner of Applying It to a Steel Tape

block was then fitted as shown and a pencil inserted.

Take the tape and set the V-notch at the desired distance, then drive a nail at the point the radius calls for and proceed to draw the arc.

I have found this a great help and saving of time in my work. An arc can be quickly drawn and the line will be a true curve and not wavy as when drawn with the aid of a pole.—Contributed by H. J. Eccleston, Norwich, New Jersey.

ⒸThe jaws on a chuck should be "eased" up before taking the finishing cut.

A Carpenter's Door Holder

When hanging a door I make a clamp by using a 6-in. strap hinge attached to two pieces of 2 by 4-in. material, each about 6 in. long, which

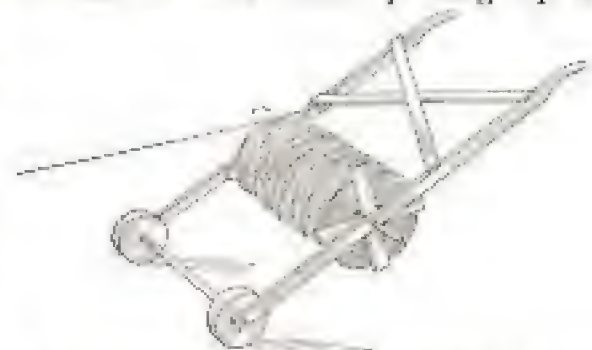


The Weight of the Door Causes the Holder to Grip the Edge Firmly

are slightly raised by cleats nailed to the under side. The hinge is so attached to the pieces that a space is left between them equal to the width of the door. When the door is placed in the opening, its weight will cause the pieces to grip the edge and hold the door firmly while it is being planed.—Contributed by Eugene Otis, Chase, B. C.

Truck for Spool Fence Wire

In the accompanying illustration is shown a handy rig for carrying a spool of barbed wire when putting up a



Fence-Wire Truck, Similar to a Baggage Truck with a Rod between the Handles for the Spool

fence. The manner of construction is obvious. The spool of wire can be easily handled by one man with this device.

A Small-Needle Drill

A hand drill for very small work in metal can rarely be obtained at the hardware or tool-dealer's store, and, if it can, it is usually very expensive. A very efficient drill, that is easily made and costs but little, can be constructed in the following manner:

First take a bar of round steel, $\frac{1}{4}$ in. in diameter and $4\frac{1}{2}$ in. long, taper one end slightly as shown, and thread it for a distance of $1\frac{3}{4}$ in. Cut two slots in this end to a depth of $\frac{3}{4}$ in., as shown at B, with a thin hacksaw blade. The slots must cross each other at right angles. A shoulder is filed at the other

end of the bar, at C, to receive the crank. An iron or brass nut, D, is screwed on the threaded end and soldered in place.

Procure a brass or iron tube, E, 1 in. long and fitting loosely on the shaft A. One end of this tube is swaged with a light hammer until it is too small to pass over the shaft, and the other end is firmly soldered to a brass or iron nut, F, so that when this nut is screwed upward on the threaded part of the shaft, the swaged end of the tube will force the jaws B tightly together, thus forming the chuck that will hold different-sized drills firmly.

Slip a washer, G, over the other end of the shaft. Procure a piece of brass tubing, H, about $2\frac{5}{8}$ in. long, which will fit the shaft loosely enough to allow the latter to turn freely. Slip this on the shaft down to the washer G. This should bring the top of the tube even with the shoulder C. An ordinary darning-cotton spool, I, is now forced tightly on this tube to form the pressure handle.

The crank, J, is made of a piece of iron or brass, $\frac{1}{8}$ in. by $\frac{1}{16}$ in., and 2 in. long. A small wood handle is riveted to one end and a hole is cut in the other end to fit over the end of the

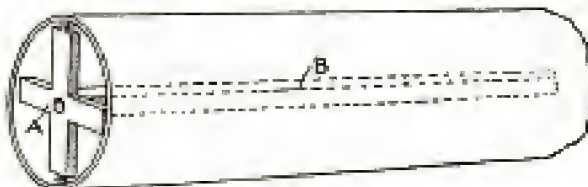
shaft C. This can be made secure by soldering, taking care to keep the flowing metal away from the tube H, so it will be free.

The drill points are easily made of different-sized needles. Break off the eye, and the point where it starts to taper. Heat and flatten one end until it spreads out on either side, but do not make it too thin. This end is then pointed and sharpened the same as any ordinary flat drill. The shank may be left round, but will be held more firmly in the chuck, if it is made square. The drills should be tempered before using and care should be taken to slightly draw the temper from the shank to keep them from snapping off at this point. When drilling, do not exert too much pressure, as this has a tendency to make the drill bend toward one side or the other.—Contributed by F. L. Matter, Portland, O.

A Spider for Lathe Work

In turning, cutting off, threading, etc., on large pipes or cylindrical work of a like nature, the free end must be supported unless the piece is very short. An old as well as a simple way to hold the end is by means of a spider or casting shaped like a Greek cross, which is tapped at the end of the arms for setscrews and drilled in the center for the lathe center. All this is shown in the sketch, which also illustrates the spider in actual service inside a length of pipe. The other end of the pipe is gripped in the jaws of the chuck.

After setting the tailstock center in the hole of the spider, the work is



Spider in the End of a Cylinder with the Brace in Position to Take the End Thrust

trued up by adjusting the setscrews in or out, as the case may be. The work can be more quickly trued up, if the spider is set approximately true before running the tailstock center

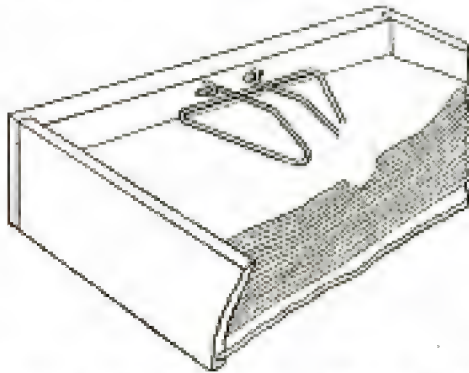
into place. Locknuts can be used to hold the setscrews where large work is being turned.

In the sketch, A is the spider, and B is a brace made of wood, which is placed between the spider and the lathe chuck to take the end thrust of the tailstock.—Contributed by Donald A. Hampson, Middletown, N. Y.

A Drawer Paper Protector

An effective device to prevent papers or clothes from becoming creased or torn when opening a drawer is shown in the accompanying sketch.

The protector is made of copper wire, about $\frac{3}{16}$ in. in diameter, bent to the shape shown and held in place with two staples. The under side of the wire rests on the paper while the



The Protector Holds the Contents While the Drawer is Pushed into Place

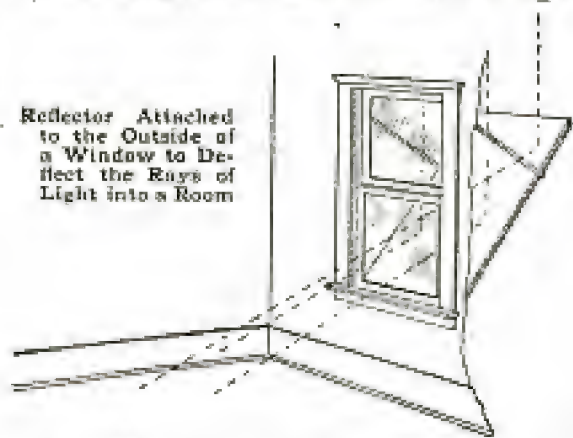
upper part is bent to come in contact with the top of the drawer slide. The protector holds the contents while the drawer is pushed into place. When the drawer is pulled out to remove the papers, the protector, which swings on the two staples, can be swung outside of the drawer where it is out of the way.—Contributed by Frank H. Mayoh, Pawtucket, R. I.

A Window Reflector

A room having a window opening into a court can be better lighted by making a reflector as shown in the sketch. A mirror is the best reflector, but, if it is considered too expensive, boards painted white will do almost as well. The bottom of the reflector is

kept away from the wall so that rain or snow can pass through the opening. This arrangement will reflect the light

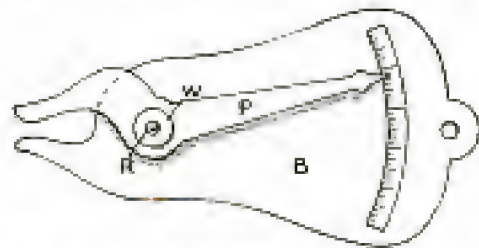
Reflector Attached to the Outside of a Window to Deflect the Rays of Light into a Room



well and will also prevent persons at other windows in the court from looking into the room.—Contributed by S. Yamashita, Hoquiam, Wash.

Indicating Outside Caliper

The illustration shows how a simple indicating outside caliper may be made. The writer constructed a caliper like this from $\frac{1}{16}$ -in. sheet steel, and found it to be very useful in determining the diameter of small rods and wires. Care should be exercised in attaching the pointer P to the main portion, or base, B, to see that there is no lost motion in the joint. A small washer, W, may be placed on each side directly under the head of the rivet R. The scale should be ruled off last, and may be marked to read in fractions or decimal parts of an inch, or both. A sec-



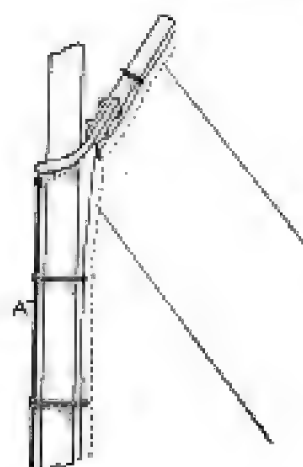
Caliper Made of Sheet Steel for Determining the Size of Small Rods and Wires

ond scale giving the gauge numbers will be very convenient in determining the size of wires.—Contributed by R. S. McClure.

⚡A slanting aerial in wireless is not as efficient as the horizontal parallel.

To Prevent the Binding of Mast Hoops

The continual binding of mast hoops



against the mast when hoisting a sail may be prevented in the following manner: A stout cord is attached to the gaff jaws and extended down the mast as shown by A in the sketch. Each ring is tied to the cord at its respective distance to hold it horizontal.—Contributed by A. L. Chetlain, Chicago.

Whetting Plane Irons

The accompanying sketch shows a device for obtaining a perfect cutting edge on plane irons or chisels, which is almost impossible to secure by the most experienced mechanic in the usual way of sharpening by hand without a guide.

The device is very simple and may be easily made by anyone with little experience, it simply consisting of a piece of pine board, A, of the same thickness as the stone B, and a pine block cut at any desired angle or bevel in which a wood screw with a washer is placed to hold the plane iron. A chisel can be held with a screw on each side of the blade. A little paraffin used



Plane Iron on a Block Having the Proper Slope for the Angle of the Edge

on the two rubbing surfaces of the wood parts will give good action without friction.

When the fine feather shows on the cutting edge of a tool treated on this device, it is better to use a small hand

stone or a smooth steel instrument to turn it back than to attempt to reverse the whole block with tool attached, it being rather awkward to handle. The former method also eliminates the danger of rounding off the straight edge of the tool more or less.—Contributed by Herman Lindenberg, Jr., W. Hoboken, N. J.

Simple Medicine Dropper

When a medicine dropper is not at hand or when it is desirable for any reason to drop the medicine directly from the bottle, a very efficient dropper may be made from an ordinary cork stopper in the following manner: Cut two small grooves lengthwise of the cork opposite to each other. When using, hold the bottle in such a way that the air will enter one of the grooves, A, and the medicine will drop out of the other, B.

The size of the grooves will depend



Two Grooves in a Cork, One for the Vent and One for the Fluid

upon the character of the liquid in the bottle. Alcoholic and light aqueous solutions require very small grooves, while for syrups and oils they must be made somewhat larger.—Contributed by W. C. Lane, N. Wilkesboro, N. C.

Repairing a Crack in Cast-Iron Pipe

A crack in a cast-iron pipe or a gasoline-engine cylinder, caused by freezing, can be repaired in the following manner, if the pressure the part has to withstand is not too great. Procure some sulphate of copper, commonly known as bluestone, and dissolve it in water. Clean the edges of the crack well with a file or sandpaper. Paint the iron with the solution several times until there is a coat of copper on it. The copper surface can be easily soft soldered, which will produce a satisfactory repair in many cases.—Contributed by Wm. W. Grant, Calgary, Can.

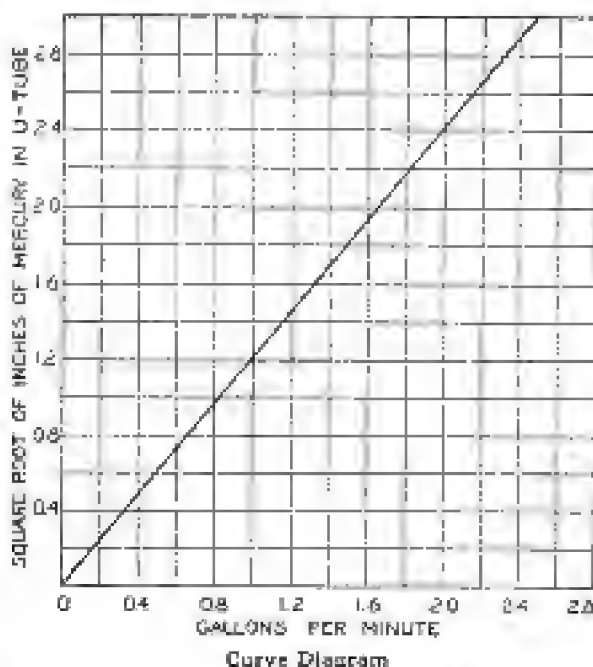
Measuring Water without a Meter

The amount of feed water pumped into a boiler is a point of interest to the engineer, says Power. If there is a water meter in the pipe line, this may be determined, but such an instrument is never correct and the reading must be multiplied with a certain coefficient in order to give the actual flow of water. To render the situation still more difficult, this coefficient varies with the speed of the meter and also with its age.

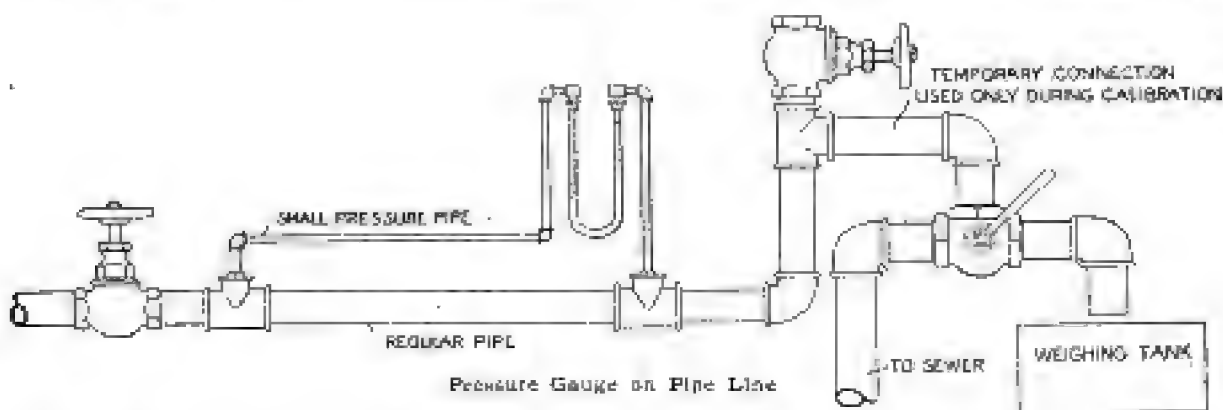
Assume that a 50-ft. pipe line is supplying a boiler with water. The amount of water flowing through the pipe may be determined in the following manner: Attach a $\frac{1}{8}$ -in. iron pipe in the far end of the supply pipe, as shown in the sketch by the small pressure pipe. Run this small pipe along the larger one to any convenient point near the boiler or other outlet, and connect it to a U-tube having a scale graduated in inches. Also connect the opposite end of the U-tube to the supply pipe and fill the bend half full of mercury.

When water is flowing in the supply pipe there will be a difference in pressure between the points where the small pressure pipe is connected to the supply pipe, causing the mercury to be elevated in one leg of the U-tube and depressed in the other. This pressure difference varies with the velocity of flow, and it is this fact which makes

which means maintaining the difference in pressures constant for a definite period, say 10 min., during which time the water is collected in a barrel and afterward weighed. For this pur-



pose cut in at some point in the supply pipe back of the U-shaped tube and put in a tee as shown. This temporary connection is supplied with a three-way valve which is used so that, while the desired difference in pressure is being obtained, the water may be flowing through one opening of the three-way valve and into the sewer. When the desired pressures are secured, the



it possible to determine the volume of water passing through the pipe.

The arrangement must be calibrated,

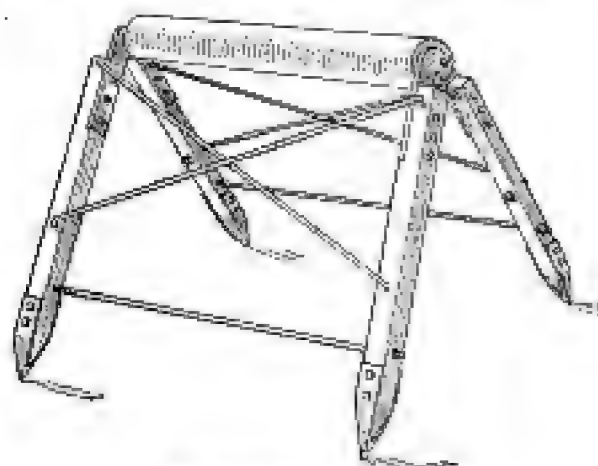
handle of the three-way valve may be turned and the stream discharged into the empty barrel which has been pre-

vously weighed. At the end of the 10-min. interval, the three-way-valve handle is again turned, and the stream directed into the sewer. In this way a number of different pressures are taken and the water collected for each. The results should be plotted as shown in the curve diagram.

Such an arrangement is not only inexpensive, but has, besides, the great advantage that, when once calibrated, it may be depended upon for accuracy at all times. Another feature is that it is not affected by hot or dirty water, or by chemicals. The distance between the points of connection of the small pressure pipe on the supply pipe should not be less than 25 ft., but need not necessarily be straight.

Adjustable Horse for the Shop

Two necessary points in the construction of an adjustable horse are the ease of adjustment and the rigidity of the base. In most cases one is sacrificed for the other. The accompanying sketch shows the construction of about as handy an arrangement for general use as can be made for a wood-working shop. There are no parts with setscrews to come loose and allow the work to fall. The jack is instantly set and, because of the extent of the base,



Roller with Adjustable Legs

it remains where set under a load, regardless of the tendency to tip as the work is moved either way over the roller.—Contributed by F. W. Bently, Huron, S. D.

Tempering Small Articles Evenly

It is quite difficult to temper a lot of small springs or other small articles and have the temper equal in all parts of each piece. The following process will be found to give an equal temper in every part of each article:

Obtain a small cup which is pressed from one piece of metal or a pieced cup with hard-soldered seams. Partly fill the cup with some animal or fish oil. Petroleum products are not good on account of their volatility.

The articles are heated to the usual color and plunged into the cup, which is to have sufficient oil in it to cover them. After being thus hardened, the cup with the oil and the articles is held over the fire until the oil takes fire and burns. After the temper has been drawn sufficiently, the cup is removed from the heat and a cover placed over it to quench the flames. When cool, the articles are removed. The articles will be found evenly tempered.

In tempering springs I usually allow the oil to burn about six minutes before quenching. As the oil can be heated to only a certain temperature, the articles receive a perfectly even heat. If the oil is burned off from the article while it is only smeared with oil, some parts will be heated more than others. If a spring is made of piano wire, it will be greatly stiffened and improved by heating it to an even blue after it is formed. The reason for this is that when the wire is coiled the metal is full of strains which the heat removes.—Contributed by J. H. Beebe, Rochester, N. Y.

Gasoline Spray for Cleaning Machinery Parts

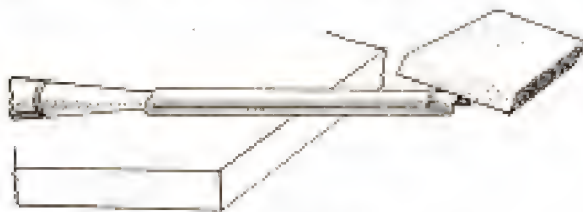
In cleaning and repairing the machinery of an automobile, gasoline is used to cut out the thick and dirty lubricating oils in bearings. It is often difficult to get the gasoline into certain places to be cleaned, and this has brought out a syringe device for use in such places.

While cleaning some computing

scales, I desired to remove some oil and dirt from the parts, and the syringe idea obtained from the automobile-cleaning device led me to try out an ordinary blowtorch I had at hand. When I desired to use the gasoline for cleaning, I opened the valve and allowed a fine stream to squirt out, which was easily directed to the spot to be cleaned.—Contributed by Robert S. Cheney, Ashtabula, O.

How to Sharpen a Gouge

Place the gouge on the bench with the back up and the cutting edge extending about 3 in. over the edge of the table. Apply the whetstone with the right hand while holding the gouge level with the left; rub the stone back and forth at right angles to the gouge



Whetting a Gouge

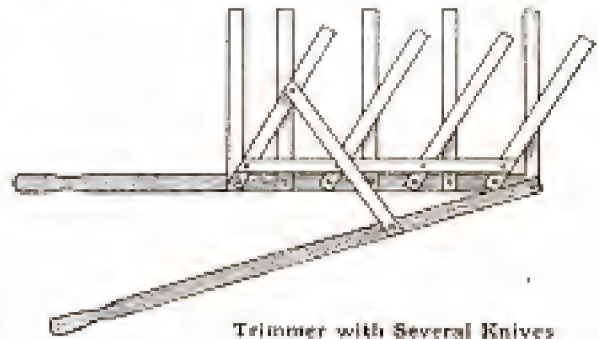
and at the same time roll it around the curve of the gouge. This method will take out nicks when using a coarse stone and also keep the cutting edge straight, which is difficult to do on a grindstone. A few strokes of a fine stone in the usual way will produce a good edge.—Contributed by L. R. Kelley, Philadelphia, Pa.

Self-Adjusting Belt Tightener

A small grinding machine, having two pulleys side by side for changing the speed, was run by a round belt. The belt was always loose on one pulley and tight on the other, and the belt would stretch so that it would slip. This was easily remedied by cutting out a piece of the belt about 5 in. long, and putting in a piece of coil spring a little shorter than the leather taken out. This spring keeps the belt tight on both pulleys.—Contributed by Newcomb D. Hollister, Truiston, New Jersey.

A Hedge Trimmer

Hedge cutting or trimming with a sickle or with hand snips is very slow and tedious work. As I had considerable hedge to take care of, I made a



Trimmer with Several Knives

trimmer with several sets of blades similar to a regular trimmer. The blades were attached to a wood handle and operated with a wood lever as shown in the sketch. The operation is the same as when using the regular hedge trimmer.—Contributed by Herman Krouskoff, New Rochelle, N. Y.

Emery-Cloth Holder

As I had a number of dirty connecting rods to polish I naturally set about to do the work as quickly as possible and with the least exertion. Emery cloth is hard to hold with the fingers and keep flat on the rod. I procured two overall buckles and attached a round piece of wood to each buckle, with a cord. A strip of emery was placed in the buckles just as a strap. The device saved me considerable



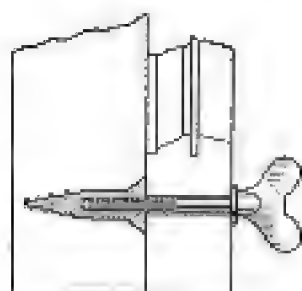
Handholds for Emery Cloth

time, and I could put on a better polish than when I held the emery cloth by hand.—Contributed by Wm. Schumann, New York City.

One of the objections to painting interiors with zinc white is that it will crack or scale, but, according to a Danish painter, this can be remedied by adding 10 per cent of whiting.

Fastener for Window Screens

An ordinary wood screw does not make a good fastening for screens, blinds, shutters and storm windows,



as the wood around the threads will become worn as the screw is removed and replaced. A good holding device is made of a short wood screw hav-

ing a large diameter into which a hole is drilled and tapped to take a thumb-screw of standard threads.

The wood screw is turned permanently into the window or door facing. The holes in the frame are bored to coincide with the threaded holes in the wood screws. It is an easy matter to turn the thumbscrew in place.—Contributed by W. C. Terry, Boston, Mass.

Removing Inner Band on Truck Wheels

Motor-truck builders and blacksmiths, in rebuilding truck wheels that have two bands, will find it a difficult matter to remove the inner band by heating, as both bands will expand alike, causing them to remain tightly together.

If it is desired to use one of these bands after the wheel is rebuilt, it will be a very easy matter to remove the inner band by driving a wedge between the two as shown in Fig. 1, making the opening the same all the

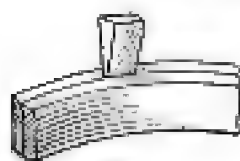


FIG. 1



FIG. 2

Driving the Wedge between the Bands, and Location for Striking the Inner One

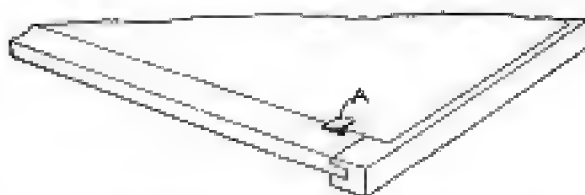
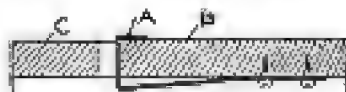
way through. Stand the bands up and leave the wedge between them and strike the metal at A A with the peen end of a sledge hammer. A few blows

will cause the inner band to come loose. The band can then be heated and straightened.—Contributed by James E. Roy, Philadelphia, Pa.

Substitute for Thumb Tacks

In making patent drawings, or when a number of small drawings of the same size are to be made, I have found the attachment shown in the sketch to be a splendid substitute for thumb tacks. A drawing board on which thumb tacks are used soon gets full of holes and becomes useless.

The bent end A of the spring clip clamps the paper B by the pressure of the spring. The spring is fastened to the under side of the drawing board



Spring Clips Used on a Board to Hold Drawing Paper of Uniform Size

C with two screws. A pressure of the finger on the under side of the clip raises it for the insertion of the paper.—Contributed by Chester E. Warner, Kalamazoo, Mich.

Preserving Surplus Stain when Staining Shingles

It is almost impossible to stain shingles without waste of staining liquid. To reduce this waste as much as possible, we used an old clothes wringer, attached to a tub, for pressing out all surplus stain at the time the shingles were dipped. As our washing machine and wringer were driven by electric motor, the latter was belted to the old wringer to drive it, while the shingles were fed into the rolls. A better job resulted when the large end of the shingles were started in first.—Contributed by Geo. Lindsay, Manitou Springs, Colo.

Tile Sewer Construction

By GEORGE M. PETERSEN

PART I

The construction of the different kinds of municipal improvements, such as sewers, streets, culverts, highway bridges, etc., are but vaguely understood by the average man. It is the purpose of this description to give facts from a practical view point so that such of the younger generation that are so inclined may obtain a good knowledge of the proper methods of doing this work, and be enabled to join the army of construction men with an amount of practical knowledge which is seldom attained except by experience.

Tile Sewers

In modern sewer construction there are several different classes of material used; the principal ones being brick, stone and concrete, for trunk sewers, while tile is used for branch or service construction. Tile is, however, generally used on small trunk sewers up to 2½ or 3 ft. in diameter. For large trunk sewers, brick is the most common material, the walls being built up of two courses. Stone

inverts or bottoms and brick arches are also used on large trunks while reinforced concrete is used for short drainage sewers and culverts. As it is the object of this article to deal only



Fig. 1

Four Forms of Sewer Tile for Laying Straight Mains, Turning Corners and Making House Connections

with the construction of tile sewers, a few points bearing on the tile may not come amiss. Tile sewers have a carrying capacity of 100 per cent more than brick sewers of the same size, and the table herewith shows the rate of discharge for the various sized tile at different grades. Sewer tile is made in sizes from 3 in. to 36 in. in diameter and in "standard" and "double"

CARRYING CAPACITY OF SEWER PIPE	Size of Pipe in Inches	GALLONS DISCHARGE PER MINUTE							
		1 Inch Fall per 100 Ft.	2 Inch Fall per 100 Ft.	3 Inch Fall per 100 Ft.	6 Inch Fall per 100 Ft.	9 Inch Fall per 100 Ft.	1 Foot Fall per 100 Ft.	2 Foot Fall per 100 Ft.	3 Foot Fall per 100 Ft.
	3	9	12	15	22	27	31	44	54
	4	20	28	35	50	62	71	101	124
	6	63	89	111	156	194	224	317	389
	8	140	198	246	348	432	499	706	864
	9	196	277	339	480	595	687	971	1180
	10	261	369	457	648	803	928	1310	1610
	12	432	612	758	1070	1330	1530	2170	2660
	15	800	1130	1400	1980	2450	2830	4010	4910
	18	1320	1860	2310	3260	4040	4660	6590	8080
	20	1720	2500	3060	4330	5305	6130	8660	10610
	24	2910	4110	5035	7191	8810	10270	14520	17790
	27	4020	5680	6960	9840	12050	13920	19680	24110
	30	5380	7618	9320	13180	16140	18640	26350	32280
	33	6950	9840	12050	17040	20865	24090	34070	41730
	36	8800	12450	15210	21565	26410	30500	43130	52820
Carrying Capacity of Brick Sewers = 50 % of Above Quantities.									

strength. The standard is usual for tile up to 15 in. in diameter, and double strength for larger sizes. Under extreme conditions double strength is

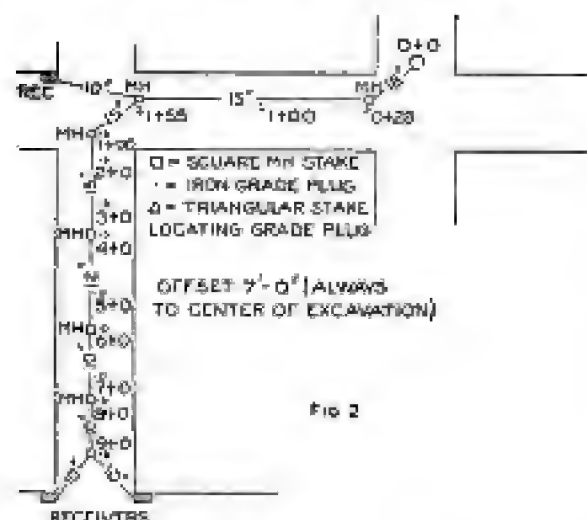


FIG. 2

The Layout Showing Depth of Cut Made by an Engineering Crew for a Street Sewer

sometimes used throughout. Sewer tile is made in forms, known as "straight," curves, connections and Y's, and shown in Fig. 1. Other shapes are made, but are seldom used.

Laying Out the Grade

The first step in the construction of any sewer is to obtain the grade, or fall. The method of determining this is as follows: The engineering crew first lays out the center line for the sewer and drives stakes at an "offset." The offset is usually from 5 ft. to 10 ft. from the edge of the proposed trench, although all offsets are figured from the center. Triangular stakes are usually used to mark the offset line and locate the grade plugs. When turning corners the stakes and plugs are set at the angles without regard to the distance, but on a straight run the stakes are placed on the even 100 ft. Each stake driven is called a station and marked as follows: 0 + 27, which means 27 ft. from the start, 1 + 89 means 189 ft. from the start, etc.; the number preceding the plus sign indicating hundreds, and the number following, the odd feet. After the stakes and grade plugs are driven, the manholes are laid out, and a square stake marked M-H is driven in the center

of the manhole. As the location can never be exactly right, a few inches or even 1 or 2 ft. change in location will not cause any trouble. The layout of the sewer would appear as shown in Fig. 2.

The grade plug is usually a 5/8-in. round iron rod about 1 1/2 ft. in length and is driven in nearly flush with the surface of the ground about 2 in. in front of the triangular stake. After all these stakes and plugs are placed, the levelman takes a level of all the plugs. The engineers then figure out the grade of the sewer and make up a list of "cuts" to be made at each station or plug. A list of cuts would appear as shown in the following table:

Station 0 + 0	Cut 8 ft. 6 1/2 in.
Station 0 + 28	Cut 8 ft. 5 in.
Station 1 + 0	Cut 7 ft. 11 in.
Station 1 + 55	Cut 8 ft. 3 in.
Station 1 + 90	Cut 8 ft. 7 in.
Station 2 + 0	Cut 8 ft. 4 in.
Station 3 + 0	Cut 8 ft. 2 in.
Station 4 + 0	Cut 8 ft. 10 in.
Station 5 + 0	Cut 9 ft. 3 in.

It will be readily seen that while 0 + 0 is actually the deepest point of the sewer, a steady rise being made from 0 + 0 to the far end, the cut is not as heavy as at station 4 + 0. This is often the case and one should not get confused if he seems to be going downward at the far end. If, however, the tile appears to be flat or with a dip toward the upper end, a level placed upon it will quickly show the actual condition.

After obtaining the list of cuts, make up a sight rod as shown in Fig. 3. As

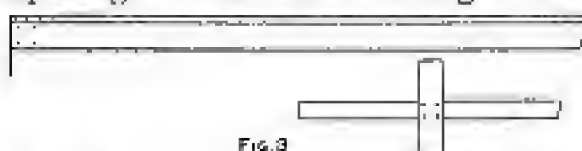
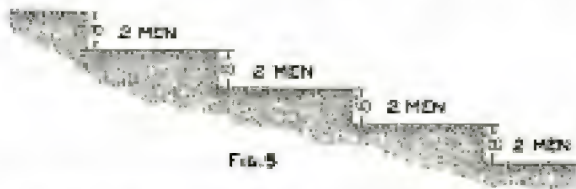


FIG. 3

The Sight Rod, with Shoe and Crosspiece, Used for Leveling Tile in Starting a Run

the deepest cut in the list is at station 5 + 0 the rod must be made accordingly. The cut being 9 ft. 3 in., the rod should be about 5 or 6 ft. longer, and a crosspiece fastened at the 13-ft. mark after the shoe is attached. Next a stake is driven into the earth di-

rectly out from the grading plug and from 4 to 5 ft. from the edge of the proposed excavation. These stakes should be made of 2 by 4-in. material, 8 ft. long, which should be pointed at one end. These are always driven in pairs as shown in Fig. 4. These pairs are called rangers. As the rangers must be set at a height of 13 ft., the "cut" must be subtracted from the 13 ft. and the crosshead attached. For example, set the rangers at station $0 + 0$ and station $0 + 28$. As the cut at station $0 + 0$ is 8 ft. $6\frac{1}{2}$ in., and this subtracted from the 13 ft. leaves 4 ft. $5\frac{1}{2}$ in., a straightedge is marked 4 ft. $5\frac{1}{2}$ in. and set upon the grade plug. Another straightedge and a level are used to transfer the 4 ft. $5\frac{1}{2}$ in. mark over on the upright without er-

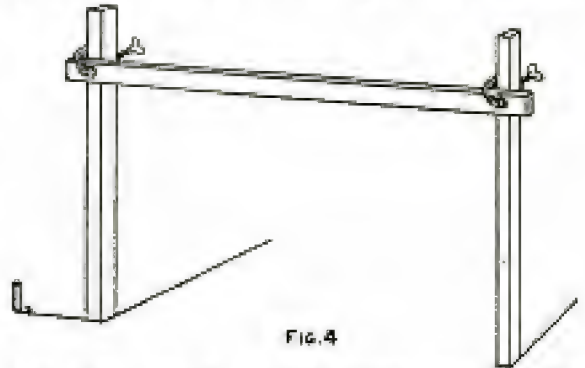


The Men are Located on Stations and Dig the Depth of the Spade on Each One

ror. A crosspiece, about 10 or 12 ft. long, $\frac{7}{8}$ in. thick and 6 in. wide, is now placed flush with the mark and fastened with a screw clamp. The straightedge is leveled and the other clamp attached. The complete ranger with crosshead is shown in Fig. 4. At station $0 + 28$ the cut is 8 ft. 5 in., which subtracted from 13 ft., leaves a remainder of 4 ft. 7 in., or the distance for the marks above the plug. The rangers should always be checked by sighting over several of them together. It is good practice to have two or three rangers set ahead and leave one or two in the rear of the work. This allows four or five rangers in line all the time and affords an excellent check before starting the work in the morning by sighting all of them before commencing work. A variation of 6 in. is permissible and is very liable to creep in. One can never be too careful about setting rangers as exactly as possible.

Excavating

The excavation should always begin from the lower or deeper end and work up grade. The best way to ex-



Two Stakes are Set over the Location of the Trench and Called Rangers

cavate for a big, wide, deepcut sewer is with a mechanical trench digger or even a steam shovel. On small jobs or in isolated districts, however, when the job will not warrant the additional cost of transportation and running expenses of the machinery, the excavation may be done by hand. There is a difference of opinion as to the best methods of doing this work. The one described is the one most used.

The width of the trench must be first determined. This is governed by the size of the tile to be used and the depth of the excavation. For the job outlined, a trench should be dug about 30 in. wide for 18-in. tile; 24 in. wide for 15-in. tile; 23 in. wide for 12-in. tile, and 20 in. wide for 10-in. tile.

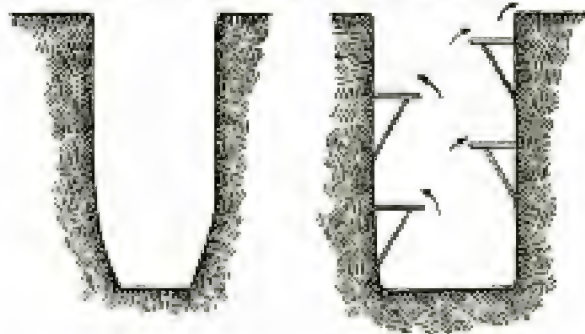


Fig. 6

Fig. 7

A Trench Narrowed at the Bottom, and Manner of Relaying Earth in a Deep Excavation

Lay out the sides of the trench and run lines along both sides as guides for the laborers so that they may excavate straight and true. The trench is marked out by two men following

the line and picking a small line in the earth with a pickax. Divide 200 or 300 ft. of the trench marked out into spaces of 20 ft. each and set a small stake. Place two men to work in each 20-ft. space. They should start the trench by working straight down to the bottom. Two men working a 20-ft. section are as good as four men working 10-ft. sections alone. Working in the manner described requires only one-half the number of pickaxes, and having more room, the laborers can naturally work faster and to better advantage. Each laborer can change from shovel to pick at half-hour intervals and do more work with less exertion. After the excavation is down to within about 4 in. of the true grade, the men are started ahead in pairs and work along as shown in Fig. 5, each pair taking a certain cut from 8 to 12 in. and working straight through on that level to the end of the entire excavation. This style of excavating is what is termed "progressive ditching."

The sides of the trench must be watched very closely as laborers have a tendency to "pull" the sides at the bottom, as shown in Fig. 6. A laborer

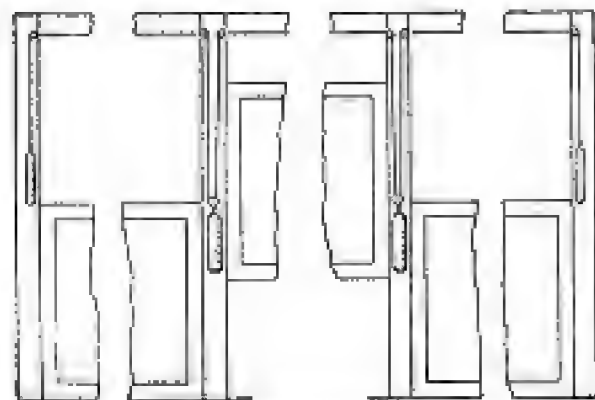
should be stationed about every 100 ft. on top of the trench after it has reached a depth of about $3\frac{1}{2}$ ft., to turn back the excavated earth and maintain a narrow pathway about 20 in. wide along the edge of the trench on both sides. This path is to allow for inspection of the trench and also to facilitate the handing of pipe and materials into the trench without knocking the excavated earth back into the trench. When excavating to a great depth by hand the trench must be wide enough to admit scaffolds on which the earth can be relayed to the surface as shown in Fig. 7.

The 4 in. of earth which remains at the bottom of the ditch are removed by the tile layer or an experienced man who immediately precedes him. If excavated by the tile layer, the earth is thrown over his head onto the tile already laid, thereby "backfilling" the trench without throwing the earth all the way out and then back. It is advisable, and in fact given in almost all specifications, to keep the excavating gang not more than 200 ft. ahead of the tile layers on account of the danger of the banks drying and caving in and filling the trench.

(To be continued.)

Weighting Triple Doors or Windows

In remodeling an old front, where there was not sufficient room between the center stiles for weights, I used the following method of weighting



Each Center Stile has One Large Weight Which is Equalized by a Pulley and Rope

them. The doors were of heavy mesh wire and weighed 75 lb. each.

I used regulation weights on the outside of each outside door in the usual manner, and weighted the adjoining edges of both center and outside doors with one weight of 40 lb. in each stile, the weight being hung on an awning pulley swung on one rope, to equalize the weight on the doors.—Contributed by F. E. Brown, Los Angeles, Cal.

Blue Letters on Steel Surfaces

The steel is heated until blue, then the letters are applied by painting in oil colors with a small brush. As soon as the color is dry the steel is immersed in strong vinegar. The blue

will disappear on all the uncovered surface. The paint is then removed with a piece of soft rag dipped in turpentine. The protected parts will show the blue color obtained by the heat.

Substitute Spanner Wrench

Many times when we have had a job that called for a spanner wrench, none of the proper size was available. I have overcome this difficulty by making a temporary spanner of a short



When Necessary a Spanner Wrench can be Cut on the End of a Piece of Pipe

length of pipe having the proper diameter, and cutting the end with a hacksaw to make the projections. This will remove the nut without injuring it in any way.—Contributed by Jas. S. Frear, Sidney, N. Y.

Proper Shape of a Screwdriver Blade

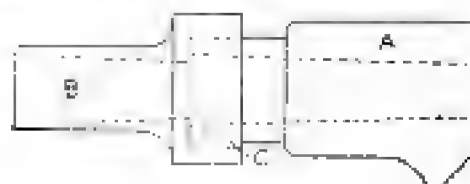
All screwdriver blades are formed wedge-shaped as shown at A. When turning large or stubborn screws the blade has a tendency to climb out of the slot which results in damaging the screw head. The best way to overcome this trouble is to shape the blade as

shown at B. The metal is slightly hollowed out, back of the edge, with a rat-tail file. When shaped in this manner, it requires no downward thrust to keep the blade in the screw slot.

An Auxiliary Drill Holder

It often happens that the taper hole in the spindle of a lathe is not a standard taper, so that the drill shank will not fit properly. This can be easily remedied by making an auxiliary drill holder to fit the end of the spindle and having a standard taper hole for the drill shanks.

The end of the holder is bored out sufficiently to fit over the end of the spindle in A, and a key, C, the same

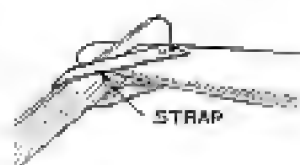


The Auxiliary Holder is Fastened on the End of the Tailstock Spindle

width as the key in the spindle, is put into it. The key prevents the holder from turning around and the holder can be slipped off and on the end without any trouble. The taper B is the same as for standard taper-shank drills.—Contributed by Chas. Homewood, Waterloo, Ia.

Tug Holder for a Singletree

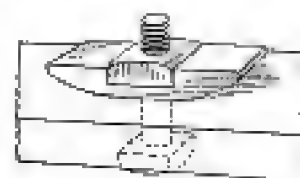
Tugs on light harness to draw buggies have slots in their ends which slip over the ends of the singletrees.



These are apt to slip off when going down an incline unless something is provided to keep the tug end in place. A good way to do this is to attach a piece of leather strap to the wood as shown in the sketch. In hitching up, the tug is run through the strap loop and slipped on the singletree end.

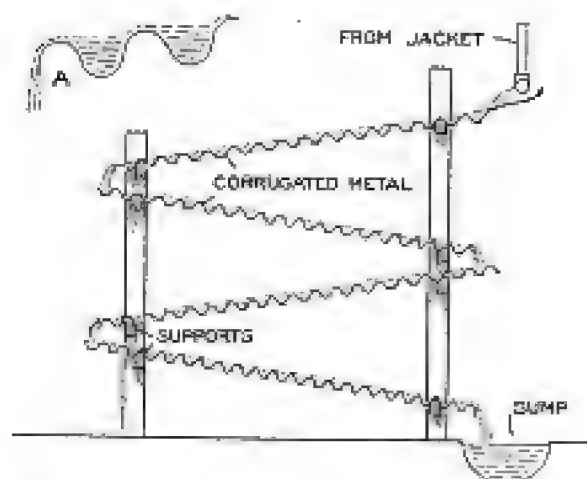
Homemade Thumbnut

A great many times a thumbnut is required when none is at hand. One can be quickly made in the following manner: Use an ordinary nut and make a wood button to fit over it, as shown in the sketch. In many places this will answer the purpose as well as the regular thumbnut.—Contributed by A. S. Thomas, Gordon, Ont.



Cooling Engine Jacket Water

Frequently the supply of water for cooling a gas engine is limited or is expensive, and it is desirable to have some means of cooling the water so



The Water Running over the Successive Corrugations of the Sheet Metal is Readily Cooled

that it can be used repeatedly. A correspondent of the Gas Engine presents a method which he used, in connection with a 30-hp. suction producer plant, to replace the tanks which are sometimes utilized for cooling the water by natural circulation.

The indicated horsepower was 40, and as it requires 5 gal. of water for each horsepower, this involved the use of 200 gal. of water an hour. Four old sheets of corrugated iron, each 20 by 8 ft., were secured from a junk heap and were erected as a series of inclined shelves, as indicated in the sectional sketch. Timber work was used as supports, the jacket water being sprayed on the topmost sheet from a pipe extending the full width of the sheet. In this pipe 36 holes, $\frac{1}{8}$ -in. in diameter, were drilled at equal distances apart along its whole length. The water runs over the different sheets successively, as shown, and finally falls into a cement sump, from which it is pumped to the engine jacket.

Sheets with deep corrugations are found to be more satisfactory, as they retain the water for a longer time, and can be set at a steeper angle. The sheets are spiked to the timbers, and each spike head should be surrounded

and covered with cement to prevent the water from dripping through and rotting the timbers. Each sheet should be cut so that it begins, at the upper end, with the concave part of the corrugation and ends, at the lower, with a convex part, as at A, thus causing the water to drop off the edge without backing up on the under side of the sheet.

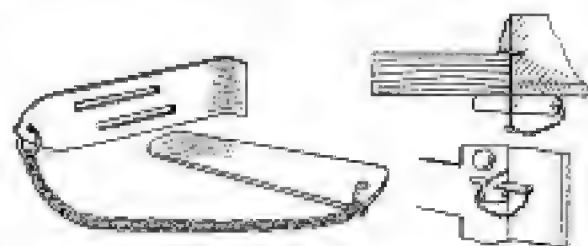
Shop Signal for the Beltman or Electrician

Being in charge of the maintenance department in a large manufacturing plant, I experienced a great deal of trouble when wishing to find the beltman or electrician in a hurry. At times there would be two or three boys running around the plant looking for them.

I have been trying a new plan for the past year and found it much better. Two lights of different colors are placed in the center of the largest shop so they can be seen from almost any part of the place. The lights are turned on and a note giving instructions hung on a nail. Any number of lights can be installed in different parts of the shop where they may be easily seen.—Contributed by H. D. Harper, St. Louis, Mo.

An Emergency Lock

The ordinary door lock of the average hotel room cannot be depended upon for holding the door against intruders. The lock shown in the ac-



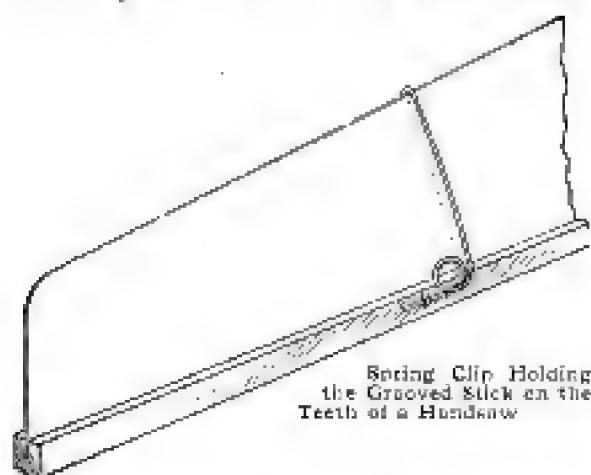
The Lock for Use in Emergency Cases and Its Application to Any Door

companying sketch makes it possible for the traveler to lock his door securely. The lock is made of two pieces

of sheet steel, formed as shown and fastened together with a small chain, so one part cannot be lost from the other. The manner of using the lock is clearly shown.—Contributed by George V. Sheridan, Brooklyn, N. Y.

Shield to Protect Handsaw Teeth in a Tool Chest

The shield is made of a small grooved stick of wood with a spring attached to hold it on the saw teeth. The spring is made of wire of the proper length with a coil at each end and fastened to the sides of the wood stick. The illustration shows the stick



Spring Clip Holding the Grooved Stick on the Teeth of a Handsaw

and spring, and the manner of attaching the device to the saw.

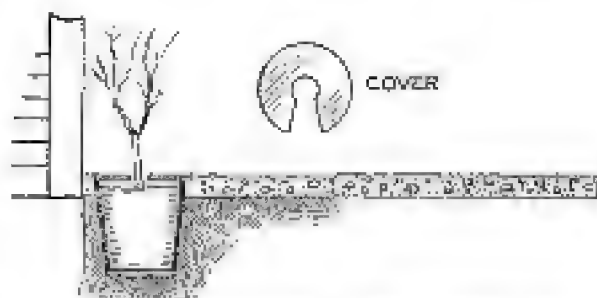
The guard can be slipped on and off easily by pressing the spring forward with the thumb.—Contributed by J. H. De Lamatter, Aurora, Ill.

Waterproofing Blueprints

Immerse in melted paraffin until saturated a number of pieces of an absorbent cloth, 1 ft. or more square. When withdrawn and cooled they are ready for use at any time, says *Railway and Locomotive Engineering*. To apply to a blueprint, spread one of the saturated cloths on a smooth surface, place the dry print on it with a second waxed cloth on top, and iron with a moderately hot flatiron. The paper immediately absorbs paraffin until saturated, and becomes translucent and completely waterproof.

Plant Pot in Cement Sidewalk

The pot holding a plant or vine at the entrance of a residence in a crowded city is usually in the way,

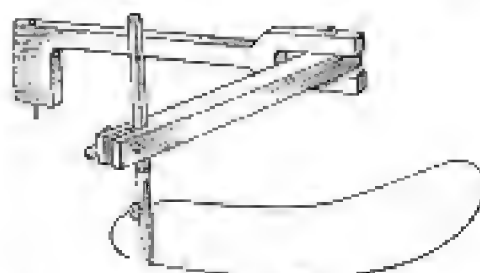


The Pot Being Placed in the Earth Keeps All Drainage Away from the Walk

and when the plant is watered the walks become wet. The illustration shows a good, cleanly way of arranging a pot or keg in the walk, so that it is out of sight, and the seeping water will be taken up by the earth. A cover may be made for the pot as shown.

Ruling-Pen Holder for Tracing Irregular Curves

Tracing indicator diagrams free-hand with a writing pen makes uneven lines of irregular thickness. Using the ruling pen free-hand is difficult because it is necessary to keep it turning in the fingers. This attachment holds the pen steady while the fingers can revolve it with ease as the point traces around the curves of the diagram. The construction can be readily understood from the sketch. A sharp-pointed nail forms the pivot



The Arm Holds the Pen Steady While It can be Turned by the Fingers

point, and a screw in the split end of the arm is used to adjust the rigidity of the pen.—Contributed by J. J. O'Brien, Buffalo, N. Y.

Special Molding Jobs from Standard Patterns

In a small shop having a varied stock of standard patterns the "stopping off" and "building on" in molds are neces-

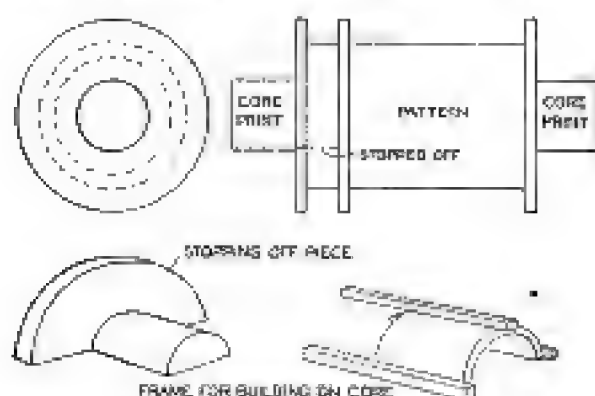


Fig. 1—Cylinder Pattern

sary on all special jobs. The patterns must be utilized as far as possible without changing them from the standard, and with a minimum of pattern work. In making changes, pieces for stopping off and building on are always used when conditions favor, and thus stock patterns are adapted to the needs of the hour with little change in their original form.

In Fig. 1 is shown a cylinder pattern with flanges on both ends and a chambered core. To shorten this cylinder, a flange is fitted around the barrel to make it the correct length and a stopping-off piece used. This is a half flange with core print attached, and is used by the molder in filling in that part of the mold not required for the

ing the flange out the required distance and filling in the intervening space to correspond with the barrel of the cylinder. If this space between the flanges is great enough to allow the sand to "stand" when the pattern is drawn, no stopping-off piece is used, but if there is not sand enough, or it is liable to "tear up" on the "draw," the stopping-off piece will be necessary. In extending the cylinder, the large part of the core must be lengthened as required. This is done with the frame for that purpose, before the cores are dried. The head of this frame, to which the three rails are attached with screws as shown, is made to fit over the small part of the core, while its outside diameter equals that of the

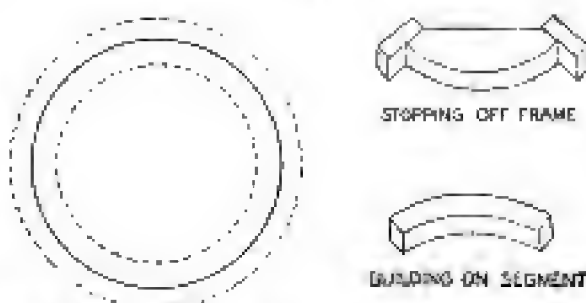
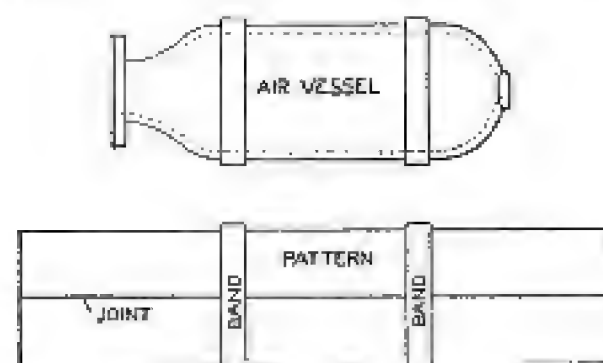


Fig. 3—Increasing or Decreasing Circular Plates

larger part. When the frame is placed on, and brought flush with the end of the core, there should be a space between the inner side of the head and the large part of the core, which, when



casting. The large part of the core is shortened by filling in the core box.

Such a pattern is lengthened by mov-

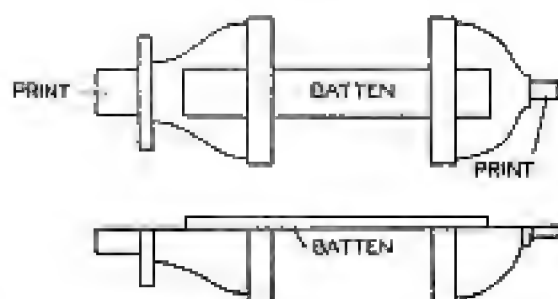


Fig. 2—Air-Tank Pattern

filled in, will make it the correct length. A small air tank is shown in Fig. 2, having a hemispherical end, stopped

from a piece of straight pipe or column. The only addition to this pattern is the bands that strengthen the casting

with a frame the reverse of the one shown. The segment for increasing the diameter of the plate is used while

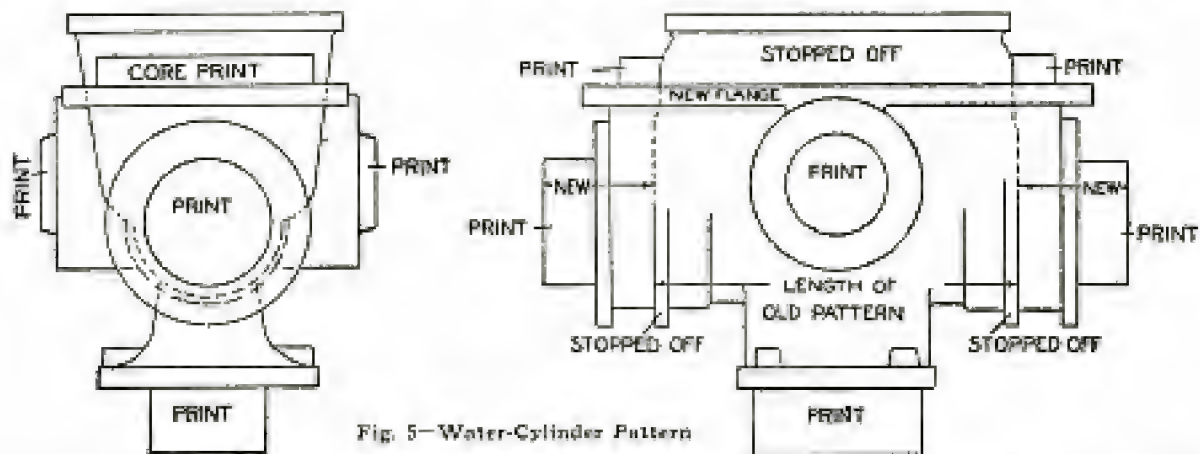


Fig. 5—Water-Cylinder Pattern

and also serve as a guide for the stopping-off piece. This is made, as the sketch shows, with two end pieces connected with a batten. This method can be easily used and the pattern adjusted to make tanks of different lengths.

Circular plates, cylinder heads, flywheels, etc., are increased or decreased in diameter as shown in Fig. 3. The black line shows the diameter of the plate pattern, while the dotted lines indicate the diameters to be stopped off or built on to produce the size required. The stopping-off segment is of a radius to correspond to the diameter of the plate required. The segment has end pieces attached to it for easy removal and to space equally all around the part to be filled in with sand. The end pieces are removed and the segment used without them while

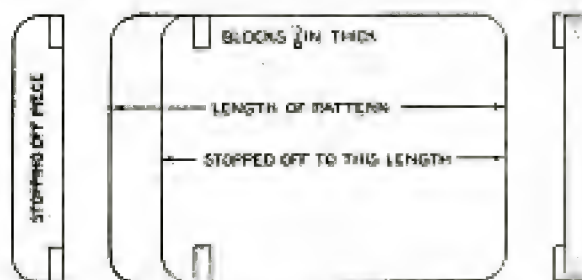


Fig. 4—Rectangular Plates

filling in the spaces left in the sand between the parts previously finished.

A round hole is increased in diameter

the pattern is in the sand. The sand around the pattern is either dug away to accommodate the segment or a level

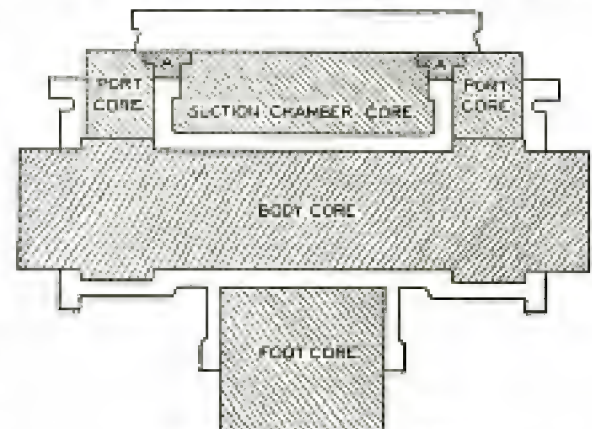


Fig. 6—Section through Mold

bed "struck up" and the diameter "rammed up" afterward. When increasing the diameter of a flywheel, where the inside of the rim provides a guide, a suitable segment is used after the pattern has been drawn.

In stopping off a square or rectangular plate, where there is nothing to locate the stopping-off piece, blocks, $\frac{3}{8}$ in. thick, are fastened to the pattern, and corresponding blocks fastened to the stopping-off piece, as shown in Fig. 4. This insures the stopping-off piece being set in the proper place.

The water cylinder, shown in Fig. 5, was lengthened and its style entirely changed, as shown in the drawing, in which is indicated the new pieces that were added to the old pattern. This

was a 24 by 30-in. cylinder, and eight castings, weighing over 6,500 lb. each, were made from the pattern. All the

side of the rails and making a bearing for the cores, which were "strickled" down to match. A piece of the proper

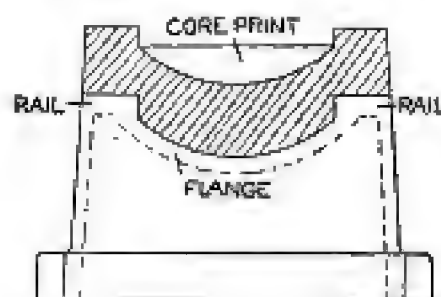
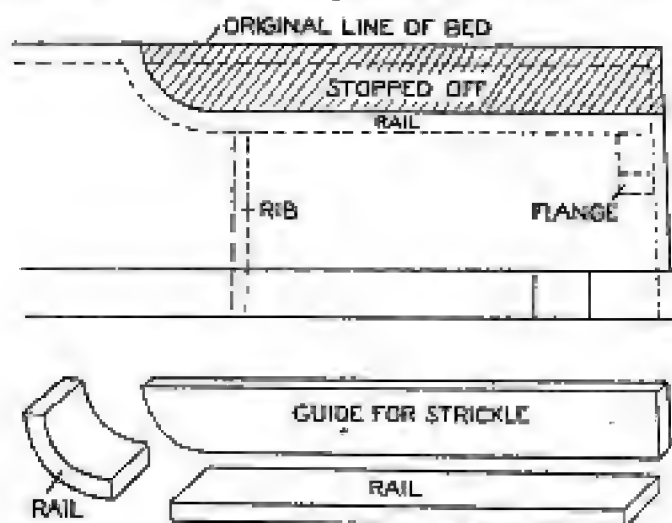


Fig. 7—An End of an Engine-Bed Pattern Which was Stopped Off in the Mold by Using Strickle Guides on Each Side and Filling in Between.

part above the new top flange was stopped off by making offsets in the port and suction-chamber cores and filling in with cores A A, Fig. 6, made for the purpose, as the plan of the mold shows. A piece as long and wide as the projecting flange was used to "strike up" a bearing for the cores.

Beds for use with different combinations of cylinders are made with a core inside, as this form is better adapted to changes. The usual plan is to make a core box long enough for the longest core and stop the shorter cores from it. A drawing is furnished the molder, as the pattern only makes a bearing for the cores, and they must be set by measurement. The end of such a bed is shown in Fig. 7. This was stopped off for a special cylinder. The stopped-off portion was approximately 2 ft. wide, 5 ft. long and 6 in. deep. This was accomplished by placing the strickle guides in the mold at each side, then filling in between and striking off the top. The guides were then drawn and the spaces left by them filled in flush. This made a "bed" in the end of the mold the exact size and shape of the part to be stopped off. On this bed the rails were placed in their proper positions against the sides and a new bed "swept up" with the rails as guides. This finished the green sand mold, bringing it up to the in-

shape was fastened in the core box to form the inside of the flange on the end of the bed, and a separate core used on the outside.

Battery Economy

To those who prefer dry batteries for all electrical work, the following method of using them on closed circuits will prove valuable. This method permits the use of dry or other open-circuit batteries on telegraph or telephone lines where the circuit must be left closed.

The ordinary methods of doing this require sufficient battery power at each end of the line to operate the system. This doubles the necessary cost of batteries, says *Electrical Review*.

The better method is to get just enough batteries to operate the system, place half of them at one end of the line and one-half at the other, and connect the zincs at both ends of the wire to one line, and the carbons to the other, or to the ground. The voltages of both sets will then be equal and, therefore, no current flows on the line.

When either party wishes to call the other, he simply reverses the connections of his set of batteries and uses the instruments. By this reversal the current of both batteries flows through the line. When through talking, he

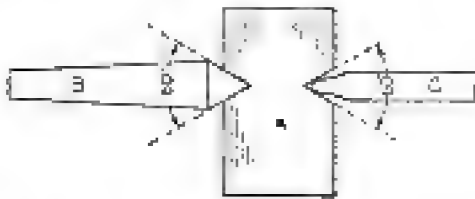
restores the connections to their original condition. The direction of the current through the line depends upon which party has called the other.

The apparatus may be grouped in any way, and distributed anywhere on the line. The only condition to be observed is that the open-circuit voltages of the two sets of batteries be equal, so that no current will flow until one set is reversed. Any kind of batteries may be used together.

Gear-Cutter Gauge

The illustration shows a gauge for setting a gear cutter in a milling machine. It is made of sheet metal, about $\frac{1}{16}$ in. thick. The two edges are filed so that they will be parallel to each other, and a line is then drawn across at right angles. Cut a 60-deg. V-notch on each side, centering the line as shown.

The gauge A is set on the index



Gauge on the Center of a Lathe Setting a Cutter Exactly in the Center

head center B, and the cutter C is adjusted to the opposite V-notch. The gauge also can be used in setting the centers of the lathe.—Contributed by G. Bogen, So. Boston, Mass.

Humidifier for a Cigar Case

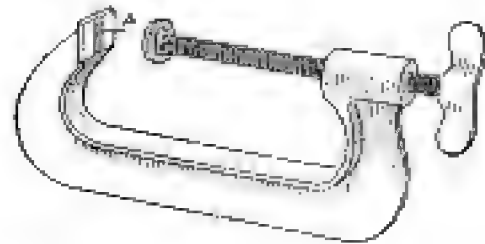
An enterprising owner of a cigar store kept his cigar cases moist by using a device described as follows: An



electric light was wrapped in sponges which were set in a dish partly filled with water. The heat of the light formed steam sufficient to keep the case moistened, with the current turned on only a few minutes each day.—Contributed by Patterson D. Merrill, Chicago.

Three-Point Bearing Clamp

An ordinary carpenter's clamp can be made to hold twice as much with half the pressure of the screw by sim-



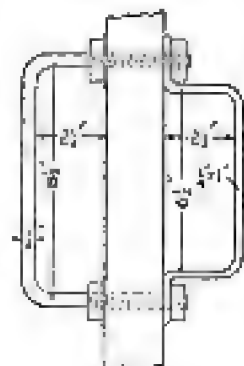
A Groove Filed in the Center of the Anvil to Increase the Holding Power of a Clamp

ply grinding or filing a groove in the center of the anvil, as shown at A. This gives a three-point bearing. No matter how much the screw is tightened on an ordinary clamp, it can be turned by taking hold of the back. This cannot be done with the three-point bearing clamp.—Contributed by F. G. Marbach, Cleveland, O.

Handle for Heavy Doors

The ordinary knob is entirely inadequate for use on the heavy doors of power houses and mills, and the cast-iron handle fastened on with screws is never satisfactory. With a badly stuck door a lever or tackle block applied to pull it open is very liable to pull off or break an ordinary handle.

An unbreakable handle that gives good results is shown in the sketch.



The dimensions given are those which actual use has proven satisfactory. The iron may be bent cold and should be smoothed up with a file after the bending. It will be seen that there are only few parts. The center of the handle should be $3\frac{1}{2}$ ft. from the floor and is located 3 in. from the casing, when the door is closed, to give safety to the fingers.—Contributed by Van Allen Lyman, Paynes Creek, Cal.

A Hand Dog

Frequently a very useful tool is also a very simple one, says American Machinist. The little hand dog shown in



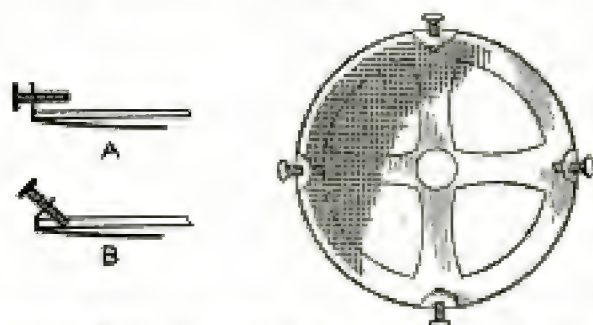
Hand Dog for Holding Small Drills When Drilling in a Small Bench Lathe

the illustration is an example. The uses of this tool are numerous. It may be used for holding a large variety of drills when drilling in a bench or small engine lathe. It is also very handy for holding small round stock while centering. In short, it does most of the work of a common lathe dog.

The body and screw should be hardened. An attractive appearance may be given it if, in hardening, a mottled effect is added, provided it is machine steel. The handle may be made solid or skeleton, and the screw, either as shown or in the form of a thumbscrew.

A Strainer Frame

An ordinary globe holder with the screw holders, A, bent inward as shown at B makes a good strainer frame. The object of bending the screw holders is to get them in posi-



Frame Made of a Glass-Globe Holder for Holding Wire Screen to Strain Paint

tion to press on and fasten the screen securely in the frame. The screen should fit snugly.

This device will be found useful for straining paint, etc. Screens of different mesh can be used and when one becomes clogged it can be withdrawn and another inserted in its place.—Contributed by Jas. M. Kane, Doylestown, Pa.

Twin China Closets

Where a kitchen is back of the dining room a built-in closet will save the housekeeper many extra steps. The closets or cupboards are placed in the wall between the kitchen and dining room, each being a duplicate of the other from top to bottom, even to the drawers in the lower part which slide either way.

The woodwork of the closets with door catches and drawer pulls in both cases should match the woodwork and fittings of their respective rooms. The upper drawer of the cupboard for the silverware should be lined with unbleached Canton flannel. The other drawers are for the table linen.

The upper part is made with glass doors on the dining-room side, and wood doors on the kitchen side. Instead of carrying dishes back and forth they are placed on the lower shelf of the closet where they can be reached from either side. This cupboard closet thus takes the place of a serving table.

The silverware, dishes and table linen, when washed, should be put in their compartments on one side and taken out for use on the other.—Contributed by Katharine D. Morse, Syracuse, N. Y.

Steel Pen Used in Draftsman's Ink-Bottle Cork

A steel pen makes an ideal substitute for a quill in the stopper of the draftsman's ink bottle. The advantage of this substitute is that there is always one handy to replace a broken or lost pen, while it is not so with the quill.—Contributed by George C. Madison, Boston, Mass.



How to Build a Simple Electric Motor

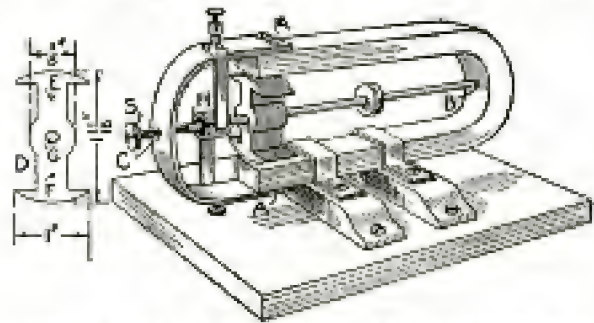
By A. G. McCLURE

An exceedingly simple and inexpensive motor that may be used in operating small toys can be constructed as follows: First procure a good permanent magnet, about 5 in. long and about $1\frac{1}{2}$ in. between the inside edges at the open end. This magnet should be at least $\frac{1}{2}$ in. thick, and if it cannot be had in one piece, two or more may be placed side by side, like poles being placed together. The writer was unable to procure ready-made magnets, so one was formed and magnetized. Obtain a piece of tungsten or some other good-grade steel, $\frac{1}{2}$ in. by $\frac{1}{2}$ in., and about 11 in. long. Bend this piece into the form of a U, with the inner edges $1\frac{3}{4}$ in. apart. Square off both ends and drill two small holes in the outside surface of each end, at AA, about $\frac{3}{8}$ in. from the end. Tap these holes for small machine screws. Drill the hole B with a small drill, about $\frac{1}{16}$ in., in the center of the lower portion of the U and ream it out. The piece should now be clamped with a good pair of blacksmith's tongs,—a block of iron being placed between the ends to keep the pressure of the tongs from drawing them together—heated to a cherry red and then plunged into a bath of oil. It can then be magnetized by placing it in contact with a permanent magnet.

Next obtain a piece of $\frac{1}{8}$ -in. brass, about $\frac{1}{2}$ in. wide and $5\frac{1}{2}$ in. long. Drill two holes in each end of the piece to match those drilled in the ends of the magnet, also one in the center, and tap it for a $\frac{1}{8}$ -in. machine screw. Now bend this piece into the

form shown. Provide a machine screw, S, for the hole C and drill a small tapered hole in the end of the screw.

Obtain a small quantity of soft sheet iron and cut a sufficient number of pieces similar to that shown at D to make a pile $\frac{1}{2}$ in. high. Cut two



Detail of Armature Laminations, and Completed Parts Assembled, but without Armature Windings

pieces of the same size from some thin sheet brass. Now place all of these pieces in a pile, the brass pieces being on the outside, and clamp them securely, then drill the two small holes, E and F. Place two small copper rivets in these holes and rivet the heads down before removing the clamp. Drill a $\frac{1}{8}$ -in. hole, G, through this piece, the armature, for the shaft to pass through. Procure a piece of $\frac{1}{8}$ -in. steel rod, about 6 in. long. Sharpen one end so that it will enter the hole B, then cut the other end off and sharpen it so that it will enter the opening made in the end of the screw S. The armature may now be soldered to this shaft, its left-hand surface being flush with the ends of the magnet.

A small commutator, H, should now be made as follows: Obtain a piece of thin brass tubing about $\frac{5}{8}$ in. in diam-

eter. Turn down a piece of hard rubber so that the tube will fit tightly on it. Drill a hole in this piece of rubber of such a size that it will have to be forced on the steel shaft. Saw two longitudinal slots in the brass tube diametrically opposite each other and then bind these two pieces in place on the piece of rubber with some heavy linen thread wrapped around each end. The armature is now ready to wind. Get a small quantity of No. 22 gauge cotton-covered wire, solder one end to one of the segments of the commutator, then wind one end of the armature full and cross over and wind the other end full, soldering the end of the wire to the second commutator segment. Make sure to wind both ends of the armature in the same direction so the current in both parts of the winding produces magnetizing effects in the same direction. Insulate the winding from the core and the different layers from each other with a good quality of thin writing paper.

Two small brushes should now be made from some thin spring brass and mounted on the brass piece as shown. These brushes should be insulated from the piece of brass and two small binding posts should be provided for making connections to them. The position of the commutator and brushes should be such that the brushes move from one segment to the other when the ends of the armature are directly in line with the ends of the permanent magnet.

A small pulley should be mounted upon the shaft to be used in transmitting the power. The whole device may be mounted in a horizontal position on a wooden base as shown, and the motor is complete.

How to Make a Humidity Indicator

A simple weather indicator that may be used in determining the condition of the atmosphere may be made as follows: Dress a small figure, in the form of a doll, with a piece of cloth, previously dipped in the following solution: Chloride of cobalt,

30 parts by weight; sodium chloride, 15 parts; gum arabic, $7\frac{1}{2}$ parts; calcium chloride, $4\frac{1}{2}$ parts, and water, 400 parts. This cloth will change color as the amount of moisture in the atmosphere changes, the change being due to the cobalt salt, which, in dry air, is lavender blue. As the moisture in the atmosphere increases, the color changes first to bluish red, then light red and finally pink, according to the amount of moisture. With a decrease in moisture, the colors change in the reverse order to that given above, and the blue color returns when the air becomes dry.

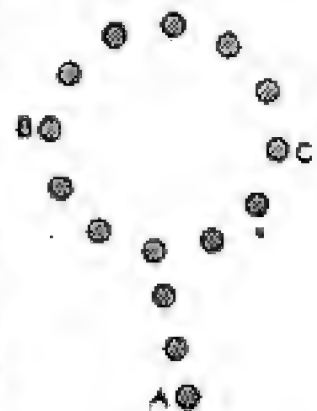
The "Q" Trick

Lay out the form of the capital letter Q with coins on a table and ask someone in the audience to select a number and then

ask that person to count up from one until the number is reached, beginning at A and stopping on the circle, for instance at B, then counting back again beginning with one, but,

instead of counting on the tail, pass it and go around the circle, say, to C. The performer gives these instructions to the person doing the counting. The one selecting the number must not tell the performer what the number is, and the latter is to leave the room while the counting proceeds. The performer, before leaving the room, is to tell which coin will be the last one counted.

Take, for example, the number 7. Counting from A to B there are just 7 coins and counting back the last number or 7 will be at C. Try 9 for the number and the last one counted will also be C. The number of coins in the tail represents the number of coins in the circle from the intersec-



tion of the tail and circle to the last number counted. For instance, the sketch shows 4 coins in the tail, therefore the last coin counted in the circle will be at C or the fourth coin from the intersection of the tail and circle.

By slipping another coin in the tail the location of the last coin counted is changed, thereby eliminating any chance of exposing the trick by locating the same coin in the circle every time. This can be done secretly without being noticed.

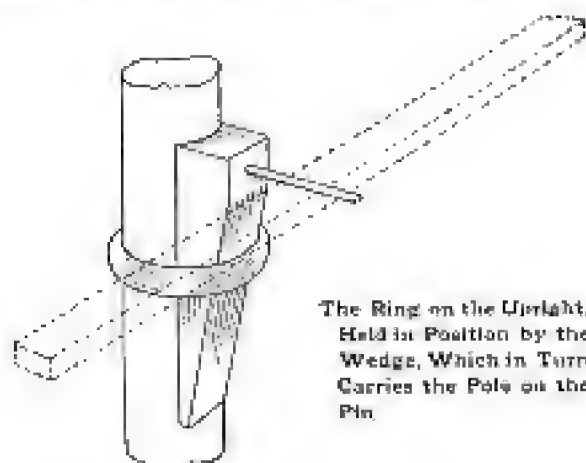
To Keep Ants Away From Food

Suspend a shelf, breadbox or rack with wire around which is tied a piece of cotton cloth, saturated with a mineral oil. The ants will not cross the oil-soaked cloth.

Some strong wire hooks attached to the rack or shelf answer well to hang small articles on, such as bacon, bags of sugar, syrup cans, etc.—Contributed by C. B. Hosford, Swansea, Ariz.

Vaulting-Pole Holder

An adjusting device for a vaulting pole that can be easily fixed at any point on a round pole by using a wedge and ring, is shown in the sketch. The wedge carries a pin on which to place the cross pole. The

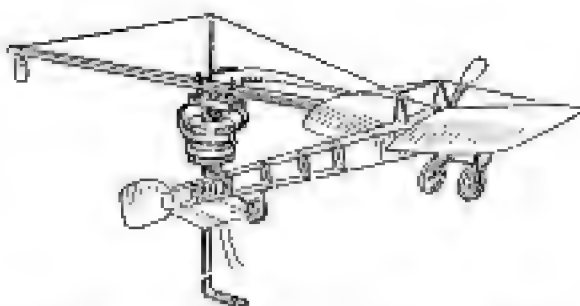
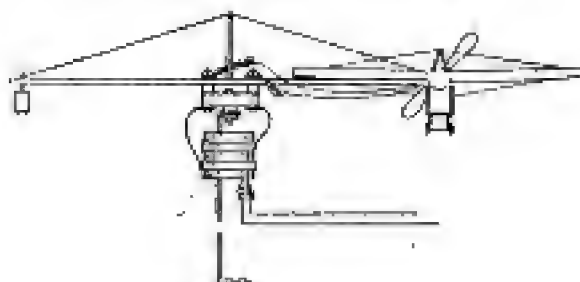


The Ring on the Upright, Held in Position by the Wedge, Which in Turn Carries the Pole on the Pin

manner of using this device as well as its construction is clearly indicated. —Contributed by Sterling R. Speirs, St. Louis, Mo.

Flying Model Aeroplane for a Display

A novelty for a window display is made of a model aeroplane flying by its own power. To control the direction and make the model fly in a circle



Detail of Parts Showing Wire Connections and Model in Flight around the Central Axis

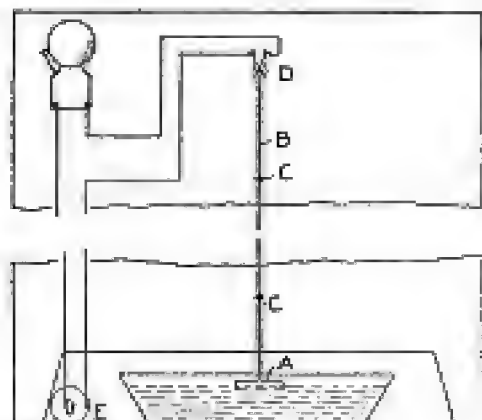
it is fastened to a long stick or beam which is pivoted in the center. The one shown was pivoted to a roller-skate wheel which in turn was fastened to a metal standard. The beam was attached to the skate wheel with two small bolts which were insulated and carried two brushes as commutator contacts.

The commutator rings were made of heavy brass strips, fastened to a round piece of wood which was attached to the metal standard. The wires from the current supply were connected to the commutator rings. From the brushes connecting wires were carried along the beam to the aeroplane motor which was a small battery motor with propeller.

The opposite end of the beam was weighted to balance it. The first sketch shows the parts and the manner of making the connections. The aeroplane is driven in a circular path by its own power in a realistic manner.

Drip-Pan Alarm

The trouble caused by overflowing of the drip pan for an ice box or refrigerator can be overcome by attach-

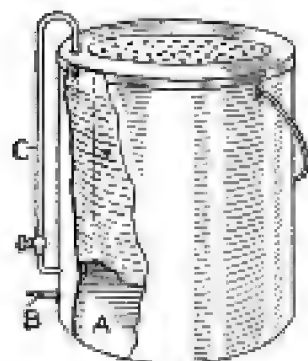


The Float in the Pan, and Contacts for Closing the Circuit to Ring the Bell

ing a device that will sound an alarm when the water reaches a level safely below the overflow point. A device of this kind may be attached to the back of the refrigerator as shown in the sketch. A float, A, is attached to the lower end of a rod, B, which slides through staples CC. At the upper end of the rod, a V-shaped copper sheet, D, is soldered. This makes the contact points in the electric wiring. The battery E can be placed under or back of the refrigerator as desired. The method of wiring is clearly shown.

A Live-Bait Pail

Every fisherman knows that live bait will soon die if they do not receive sufficient air. I have succeeded in



keeping bait alive and healthy by using a pail of my own construction, which is provided with a compressed-air space to force air to the surface of the water. The air space A takes up one-fifth of the interior at the bottom of the pail, and an ordi-

nary hand bicycle pump is used to fill it through a bicycle-tire valve, B. The pipe C from the air space extends up along the side of the pail and the upper end is bent so that it just touches the surface of the water. The pipe contains a valve to regulate the flow of air.

After the pail has been standing for an hour or more, the bait will rise to the top. The valve is then opened for a few minutes, and the minnows will soon swim around in the water as when this was fresh.—Contributed by T. Whelan, Paterson, N. J.

A Mouse Trap

After using various means to catch the mice in my pantry, I finally decided I could not catch them in the ordinary manner. Knowing that mice are not afraid of dishes but will run all over them, while they will stay away from other things, I took a dinner plate, a bowl that held about 1 qt., a thimble, filled with toasted cheese, and arranged the articles as shown in the sketch, balancing the bowl on the thimble. When the mouse nibbled the cheese, the bowl came down on it, making it a prisoner. The whole was then dropped in a pail of water. Scald the dish and bowl before using them again to remove all traces of the mouse.



Quickly Made Rheostat

A short time ago I found it necessary to melt some silver, and in setting up an arc light to obtain the heat I made a rheostat by winding wire around a large earthenware jar. As the jar is a non-conductor and would not burn, it served the purpose perfectly. In winding the wire, be careful to keep the coils from touching each other.—Contributed by P. D. Merrill, Chicago, Ill.

Leaded-Glass Panels for Furniture

Certain kinds of furniture may be greatly improved in appearance by the use of simple glazed panels in the door frames. It would be inappropriate to have anything elaborate in a small cabinet for the reception of china as it distracts the attention from the contents, but a simple leaded diapering or pattern of small design, such as shown in Figs. 1 and 2, would be quite in place and have a good effect. For other purposes more elaborate effects can be worked out in deep shades, says Work, London.

A hanging cabinet with leaded panels is shown in Fig. 3. These panels for the doors are in the design shown in Fig. 2. Panels of this design can be used either for furniture or for small windows. The process of making these panels is not difficult and the ordinary workman can form them, the only difficult part being the soldering of the joints.

The beginner should confine himself to plain glazing, the design being formed by piecing together glass of different shades. The method of procedure is to first make a small sketch in color to a scale of about 1 in. to the foot, carefully arranging the parts and colors. A full-sized panel can be drawn from this sketch. The effect of

plain glazing depends entirely on the arrangement of the lead lines and the art glass. In the full-sized drawing

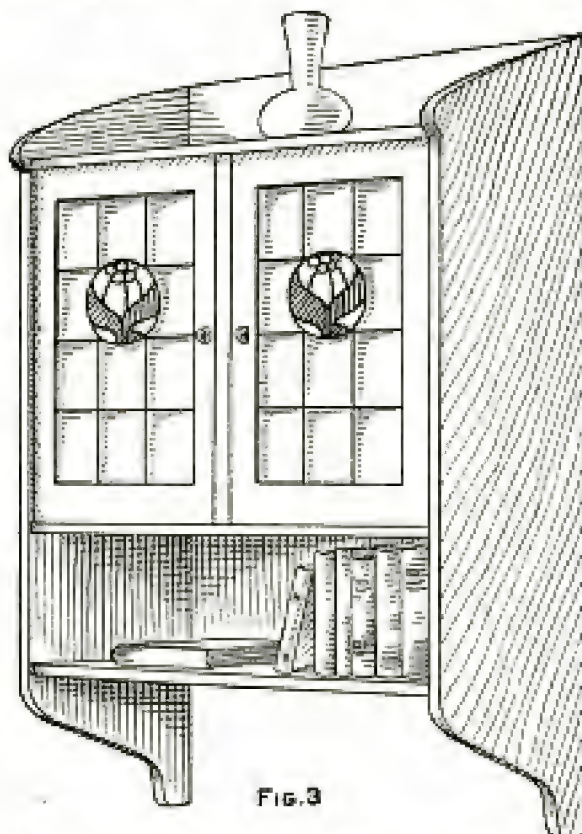


FIG. 3

A Small Hanging Cabinet with Doors Having the Leaded-Glass Design Shown in Fig. 2

the shapes are arranged so that they may be easily cut, all long forms being either avoided in the design, or divided by a cross-lead to guard against breakage in the cutting.

Two simple forms of glazing are shown in Figs. 1 and 2. The one shown in Fig. 4 is somewhat different, the top of the panel being decorated with simple curves. This general design is considerably elaborated in Figs. 5, 6 and 7. It is desirable to decorate only a part of a window so that the maximum of light may gain access.

Two simple treatments of a sailing craft are shown in Figs. 8 and 9. The effect of the introduction of this design in one of the panels of a small cabinet is shown in Fig. 1.

An example of plain glazing is shown in Fig. 10. This is a piece of

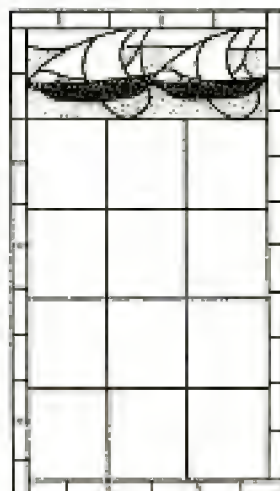


FIG. 1

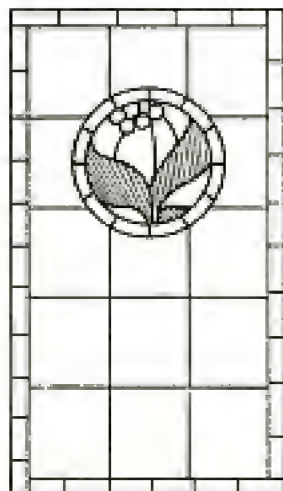


FIG. 2

Simple Leaded Diapering of Small Design for a Small China Closet or Cabinet

simple leading and yet very effective, involving no difficulty of construction.

For this lead glazing a quantity of strip lead, the section of which is



FIG. 4

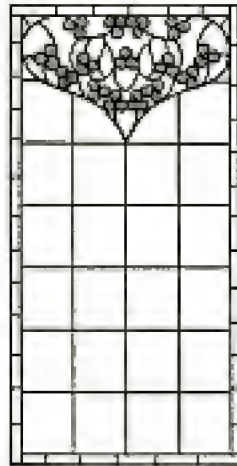


FIG. 5

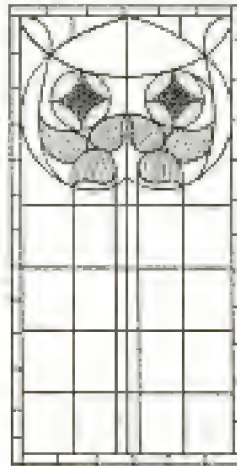


FIG. 6

Only a Part of the Top of Each Window is Highly Decorated so That the Maximum Light may Gain Access.

shown in Fig. 11, will be required. This can be purchased from dealers in art-glass supplies. The lead is sold on spools and it must be straightened

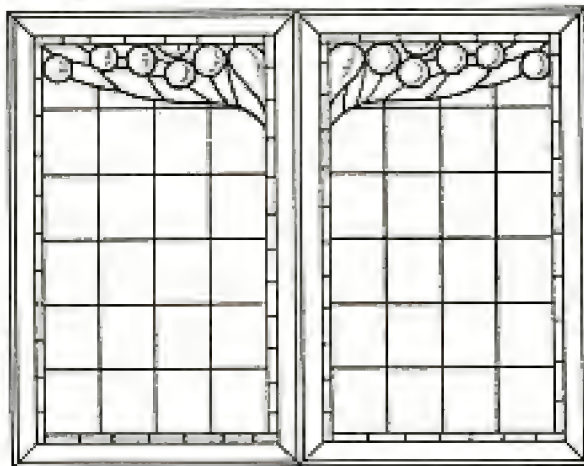


FIG. 7

Two Windows Placed Together May Have Their Tops Leaded to Produce a Combined Effect

before it can be worked. This is most easily done by fastening one end and pulling on the other. The glass for this work must be reasonably thin as no advantage is gained by the use of thick material, and it is difficult to cut. A piece of art glass has a right and a wrong side, the side on which the spots and streaks appear is the right side, and it is cut on this side. The tools required are a glass cutter, a heavy knife and soldering appliances.

Sketch out the lines of the design full size on paper, drawing in only one side of a symmetrical pattern and tracing the other. After the design has

been prepared, the next step is to make a cutting pattern. To do this, take a piece of tracing cloth and lay it on the drawing. Trace the lines and go over them with a brush dipped in black, making the lines exactly the same thickness as the core of the lead, or the thickness of the distance the glasses are separated from one another, as shown in Fig. 11. Each division is marked for the color it

is to be and the paper is then cut into sections on each side of the broad line. These pieces form the patterns for cutting similar shapes from heavy cardboard which serve as templates for cutting the glass.

Proceed to cut the glass by laying a pattern on the right side and scoring around with the cutter guided by the pattern. Little difficulty will be experienced in this work if the general design does not have very irregular shapes.

When the various pieces of glass

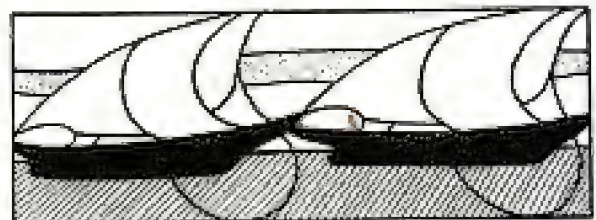


FIG. 8

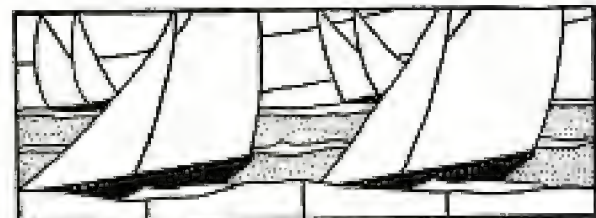


FIG. 9

Two Designs for the Tops of Windows, Showing Treatments of Sailing Craft

have been successfully cut and are ready for leading up, arrange them in position on the preliminary sketch, and then measure the outside leads and cut one piece for each side, the lead being cut to fit against the core of the other at the joint, as shown in Figs. 12 and 13. Proceed to cut the lead for the long curves, obtaining the length by bending the strips along the lines of the design. As each is cut it will be found convenient to tack it in position on the working table by means of small brads, so as to simplify the measuring and cutting of the other parts. Continue until the panel is complete, when, after truing up, it is

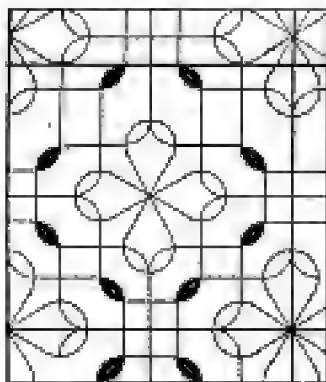


Fig. 10

Example of Plain Glazing with Cross-Section of Glass and Lead Strip, also Showing Joint



Fig. 11



Fig. 12



Fig. 13

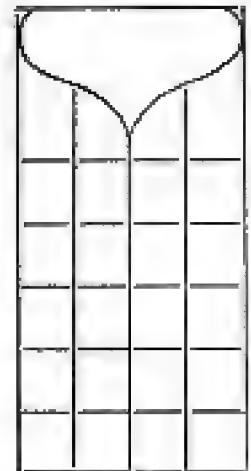


Fig. 14

The Lead Frame is First Made, the Long Lines are Put in and Then the Short, Horizontal Ones

ready for soldering. This is done in the usual way but requires extraordinary care to avoid the possibility of melting the lead. The overlapping parts of the leads are pressed well against the glass in each division to keep it from rattling.

In making up the squares and rectangles such as appear in Figs. 2, 4, 5, 6 and 7, lead the long lines first, adding the shorter, horizontal pieces last. The sketch, Fig. 14, will clearly illustrate this part of the work. The sketch shows the starting of the panel, Fig. 5.

Raising Cucumbers on a Trellis

A novelty in cucumber culture, tried recently with great success, is as follows: As soon as the vines are about 18 in. long, stretch wire mesh 24 in. wide on poles alongside the row of plants and train the vines on the wire. The cucumbers will grow larger and the plants will require less care than when they are on the ground.

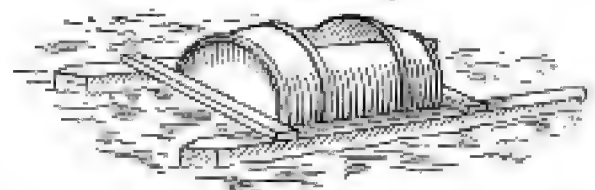
A Barrel Boat

A boat that any handy boy can easily make is constructed of a barrel which is kept with the opening cut in one side up by two 4 by 6-in. timbers and two tie pieces, 2 by 4 in. The lengths of these pieces will depend on the size of the barrel.

A good watertight barrel should be

selected and an opening cut in the center between the hoops, of such a size as to allow the body of the occupant room for handling an oar. The timbers are attached to the barrel with iron straps—pieces of old hoops will do. The two tie pieces are put across the timbers at the ends of the barrel and spiked in place.

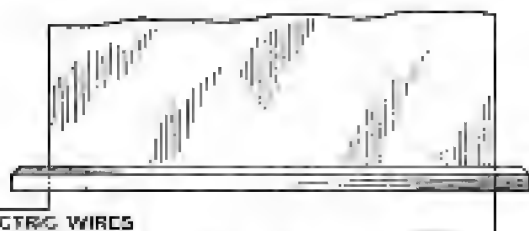
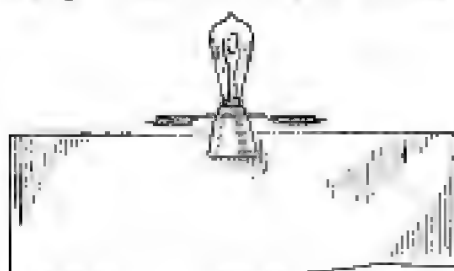
The boat is to be propelled with a single, double-end paddle. There is no danger of the boat capsizing or the water splashing into the barrel.



Boat Made of a Barrel Which is Kept from Capsizing by Timbers Attached

Electric-Light Mystery

A novel attraction for a window display can be made of a piece of plate glass neatly mounted on a wood base,



Electric Light Mounted on Top of a Plate Glass with Hidden Connections on the Glass Edge

and an electric light which is placed on the top edge and may be lighted apparently without any wire connections.

The method of concealing the connections is to paint the edges of the glass green, then, before the paint is quite dry, lay on a thin strip of copper, making the connections at the base on both sides, and to the lamp in the same manner. Another coat of paint is applied to cover the strip. The color should be an imitation of the greenish tint of glass edges. Any desired lettering can be put on the glass. —Contributed by O. Simonson, Brooklyn, N. Y.

An Oar Holder

Persons rowing boats, particularly beginners, find that the oars will slip out of the oarlocks, turn or fall into



The Screw eye in Position on the Oar and over One Prong of the Oarlock

the water. This may be avoided by turning a screw eye of sufficient size to prevent binding on the lock into the

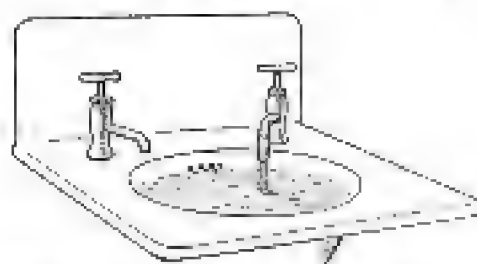
oar and placing it over the lock as shown at A, so that the pull will be against the metal. The oars will never slip or jump out, will always be in the right position, and it is not necessary to pull them into the boat to prevent loss when not rowing. The locks will not wear the oars, as the pull is on the metal eye. Place the eye so it will have a horizontal position on the side of the oar when the blade is in its right position.

Cooking Food in Paper

A flat piece of paper is much more convenient to use than a paper sack in cooking, as it can be better fitted to the size of the article to be cooked. Wrap the article as a grocer wraps sugar, folding and refolding the two edges together until the package is of the proper size, then fasten with clips and proceed to close the ends in the same way. This avoids all pasted seams and makes the package airtight. —Contributed by J. J. A. Parker, Metamora, O.

Washing Photograph Prints

Photographic prints may be washed in a stationary washbowl with just as good results as if washed in a high-



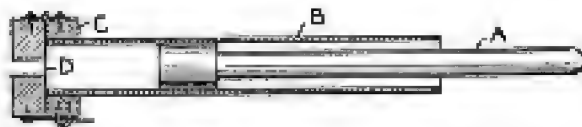
A Medicine Dropper on a Faucet Produces a Whirling Motion of the Water in the Bowl

priced wash box, by cutting off the upper end of the rubber nipple on a bent glass medicine dropper and placing it on the faucet as shown in the illustration. This arrangement causes the water to whirl around in the bowl, which keeps the prints in constant motion, thus insuring a thorough washing. —Contributed by L. O. D. Sturgess, Arlington, Oregon.

A Toy Poppun

A toy popgun can be easily made of two blocks of hard wood, $\frac{1}{2}$ in. thick; a joint of bamboo, about $\frac{7}{8}$ in. in diameter and 6 in. long; a small hinge, a piece of spring steel, $\frac{1}{2}$ in. wide and 1 in. long, and a piece of soft wood for the plunger.

The plunger A is cut to fit snugly, yet so it will move easily in the piece of bamboo B. One of the blocks of hard wood, C, is bored to fit one end of the bamboo, the other block has a $\frac{1}{4}$ -in. hole bored, to center the hole in the first block. The two blocks are hinged and the spring latch attached as shown in the sketch. The spring has a hole drilled so it can be fastened with a screw to the outer block, and



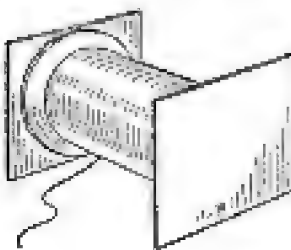
Detail of Poppun, Showing the Parts Assembled and Position of the Paper

a slot cut in the other end to slip over a staple driven into the block C.

A piece of paper, D, is placed in between the blocks while the plunger A is out at the end of the bamboo. A quick pressure on the plunger A will cause the paper D to break out through the small opening with a loud pop.—Contributed by Paul H. Burkhardt, Blue Island, Ill.

A Non-Rolling Thread Spool

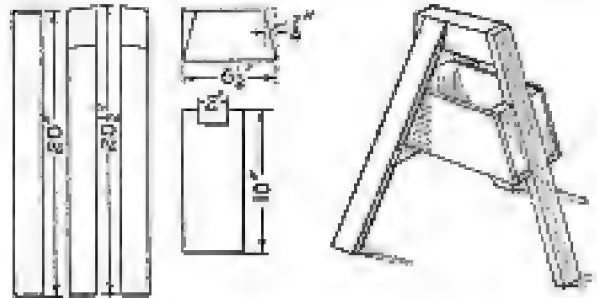
A spool of thread may be kept from rolling by gluing squares of cardboard to the ends. The squares should



This will save many a step and much bending over to pick up the spool. The spool, when it falls, will stop where it landed.—Contributed by Katharine D. Morse, Syracuse, N. Y.

Shoe-Shining Stand

To anyone who finds it tiresome to shine his shoes while putting the foot on the rim of a bathtub, on a cook-



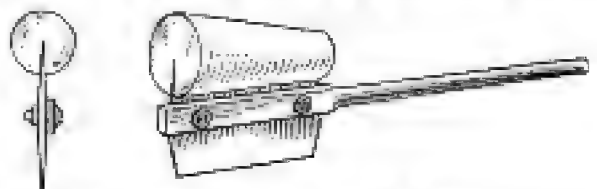
Dimensioned Parts and Completed Stand Which has a Box to Hold the Shining Outfit

stove or chair with a newspaper on it, the stand here described will afford relief and at the same time he will always have the shining outfit ready for use.

The whole is of pine, the foot rest being made of a piece 2 by 4 in.; the legs, of 1 by 2 in., and the bottom of the box, of $\frac{1}{2}$ by $4\frac{1}{4}$ in. All other dimensions are given in the sketch. After the legs are attached and the bottom of the box in place, the sides are fitted and fastened with nails.—Contributed by Samuel Hughes, Berkeley, Cal.

Cutter Made of a Wafer Razor Blade

A useful instrument for seamstresses and makers of paper patterns and stencils can be made of a piece of steel



The Wafer Blade Attached to the Handle, the Top Edge being Protected with a Cork

or iron and a wafer razor blade. The end of the metal is flattened and two holes drilled to match the holes of the razor blade. Small screw bolts are used to attach the blade to the handle. Place a cork on one edge as a protection for the hand of the user.—Contributed by Maurice Baudier, New Orleans, La.

A Fish Stringer

The illustration shows a very simple and inexpensive device for the angler to string and carry fish. It is



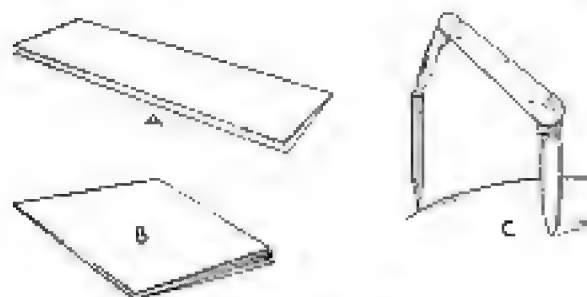
Inexpensive Stringer Made of a Pail Handle and Small Chain

made of a pail handle through which is passed a piece of soft wire, having sufficient length for bends or loops at each end, and a piece of chain. A chain 18 in. long is sufficient. One end of the chain is fastened in the loop at one end of the handle, and the other has a piece of wire attached for pushing through the gills of the fish. The other end of the wire through the handle is arranged in a hook to catch into the links of the chain.—Contributed by G. O. Reed, Stratford, Canada.

Substitutes for Drawing Instruments

Three of the most used draftsman's instruments are the compass, ruler and square or triangle. When it is necessary to make a rough drawing and no instruments are at hand, common and easily obtainable things can be used as substitutes.

A sheet of heavy paper folded as



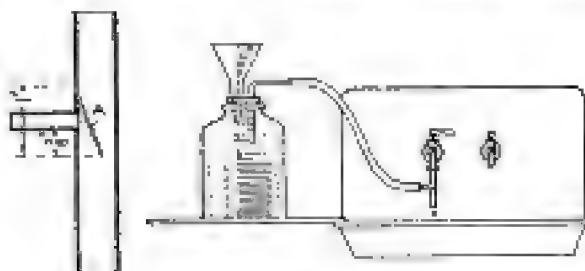
A Compass, Ruler and Square Made of Ordinary Things at Hand

shown at A will serve as a ruler, and the same sheet given another fold will make the square B. If given another fold diagonally, a 45-deg. triangle is

formed. A substitute compass is readily made of a short pencil and a pocket knife, as shown at C.—Contributed by Jas. J. Joyce, Olongopo, Philippine Islands.

How to Make an Aspirator

A simple aspirator that may be used for a number of different purposes, such as accelerating the process of filtering, emptying water from tubs, producing a partial vacuum in vessels in which coils are being boiled in paraffin, etc., may be constructed as follows: Obtain two pieces of brass tubing of the following dimensions: one 7 in. long and $\frac{3}{4}$ in. outside diameter, and the other, 3 in. long and $\frac{1}{4}$ in. outside diameter. Drill a hole in one side of the large tube, about 3 in. from one end, of such a diameter that



Detail of the Aspirator and Its Connections to a Faucet, for Increasing the Speed of Filtration

the small brass tube will fit it very tightly. Take an ordinary hacksaw and cut a slot in the side of the large piece, as shown at A. This slot is sawed diagonally across the tube and extends from one side to the center. Obtain a piece of sheet brass that will fit into this slot tightly, and then solder it and the small tube into the large tube. The slot and hole for the small tube should be so located with respect to each other that the small tube will empty into the larger one directly against the piece of sheet brass soldered in the slot.

The upper end of the large tube should be threaded inside to fit over the threads on the faucet, or an attachment soldered to it similar to those on the end of an ordinary garden hose. A rubber hose should be attached to the small tube and connected, as

shown, to a piece of glass tubing that is sealed in the cork in the top of the large bottle. The funnel holding the filter paper is also sealed into the cork. Melted paraffin may be used in sealing the glass tube, funnel and cork in place, the object being to make them airtight. The filter paper should be folded so that it sticks tightly against the sides of the funnel when the liquid is poured in, thus preventing any air from entering the bottle between the paper and the funnel. Turn on the faucet, and it will be found that the time required to filter any liquid will be greatly reduced. Be careful, however, not to turn on too much water, as the suction may then be too strong and the filter paper become punctured.

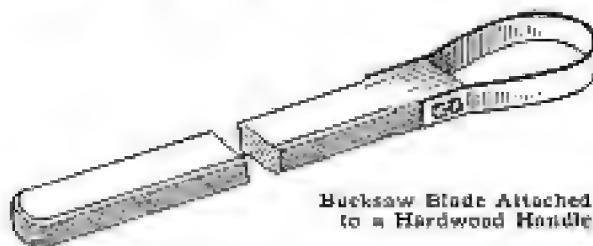
A Key-Holder Hook

A good hook for hanging keys, toothbrushes and other small articles can be made from ordinary wire staples, as shown at A. One leg of the staple is cut away as shown at B and the other leg driven into the board as shown at C. These will answer the purpose as well as screw-hooks.—Contributed by W. C. Heidt, Chicago.



A Hand Hoe

A hand hoe, especially adapted for weeding or cultivating small truck, particularly onions, can be made of a piece of hard wood, $\frac{7}{8}$ by $1\frac{3}{4}$ in. by 4 ft. long, and a piece of old bucksaw blade. A blade, 18 in. long and 2 in.

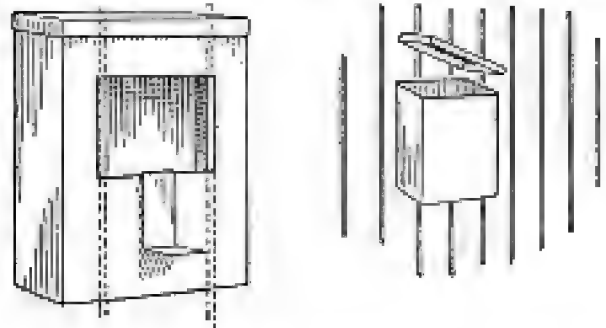


Bucksaw Blade Attached to a Hardwood Handle

wide, bent into a loop is attached with bolts to the handle.—Contributed by Geo. H. Miller, Iowa City, Iowa.

Seed Receptacle for Bird-Cages

A handy seed and water container for a bird-cage can be made of a common spice tin. The receptacle can be



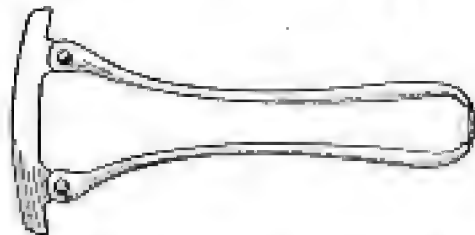
Spice Tin Attached to the Wires of a Bird-Cage for a Water or Seed Receptacle

filled without removal by simply taking off the cover. Thus the seed will not be scattered.

The tin is attached by cutting a hole in the back as shown, and bending the side edges to fit over the wires to hold it in place. The bottom strip is a support which rests on the floor of the cage and prevents the tin from slipping down on the wires.

Kitchen-Utensil Scraper

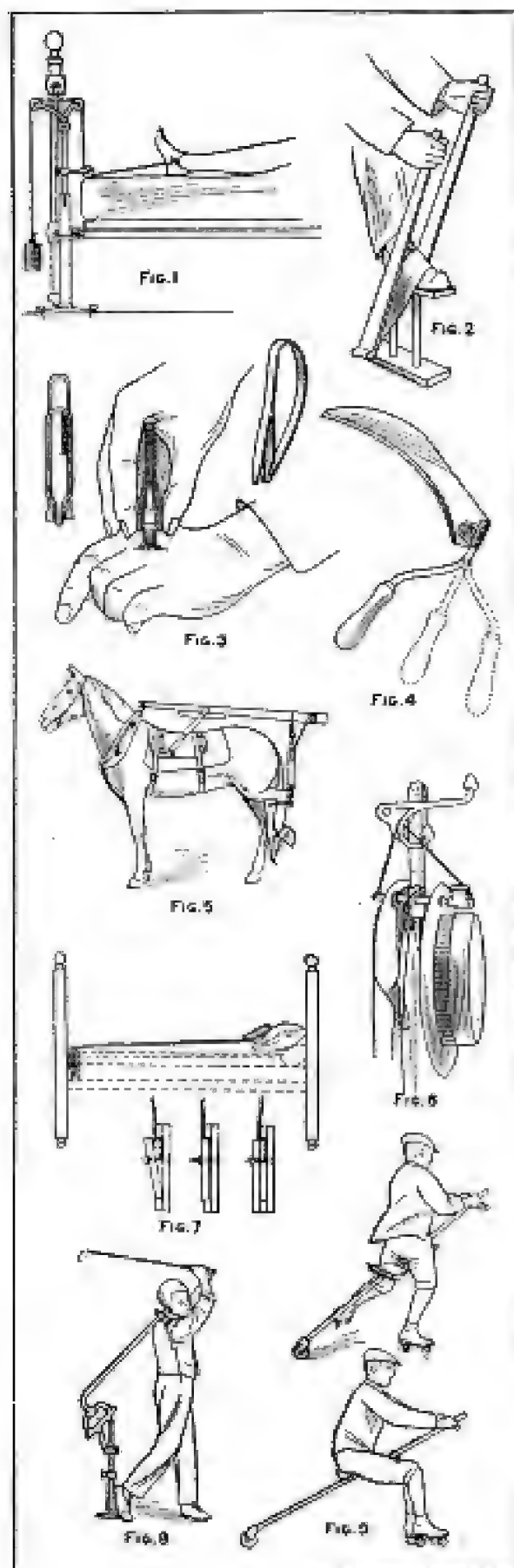
A flexible utensil scraper is one of the most useful articles I have in my kitchen. It covers such a large surface



The Blade is Flexible so It can Readily Shape Itself to the Curves of a Kettle

in scraping pans, kettles, etc., that this most disagreeable part of the kitchen work is quickly and easily accomplished.

The flexible blade is attached to the tin handles with small rivets. The blade should be thin and narrow enough to allow it to bend. When the handles are pressed together, the blade curves to the shape of the utensil's surface.—Contributed by Mrs. Della Schempp, Brodhead, Wis.



INTERESTING PATENTS.

LEG-PULLING APPARATUS—An apparatus for pulling or stretching the lower limbs of a person, a treatment used in certain hip diseases, etc., is shown in Fig. 1. A vertical post, carrying pulleys, is attached to the foot of the bed, and a cord, bearing weights on one end, is run over the pulleys and attached to the ankle of the subject. The weights, which are similar to those of a weighing scale, may be increased or decreased in number as the treatment requires.

ARM-OPERATED SHOE CLEANER (British patent)—Figure 2 shows a shoe-cleaning and polishing apparatus comprising a stand on which to place the foot, and a band of cloth with a wooden arm attached to each end. The cleaning or polishing cloth is worked over the shoe by means of the wooden arms, the purpose of which is to do away with the necessity of stooping down to reach the shoe. Some kind of a pulley arrangement that would allow the strip of cloth to be worked over the shoe by pulling and pushing the arms or levers, instead of working them loosely up and down, would seem to be a practical improvement.

SLIVER-REMOVING TWEEZERS (British patent)—A pair of tweezers, especially designed for the extraction of splinters, hair, etc., from the flesh, is shown in Fig. 3. The tweezers are provided with means for pressing on the flesh surrounding the splinter, thereby preventing the flesh from being pulled up with it, and also assuring, by pushing the flesh down from the splinter, a firm hold upon the latter. In the form of tweezers shown in operation, the pressure of the palm on the spring head holds down the flesh as the tweezer arms are raised upward in withdrawing the splinter. In the modification shown at the right, the points of one arm are adapted to grip the splinter and slide up the inclined arm when pressure is exerted, while the modification shown on the left is a form similar to the first, but having the spring connected to one of the pressing legs.

COMBINED SICKLE, CORN KNIFE AND PRUNING SAW—Figure 4 shows a combination tool which may be used for pruning small trees and shrubs, for cutting the grass of lawn borders, and as a corn knife. The handle is adjustable to the positions shown in the drawing.

HOOF SUPPORT FOR HORSESHOEING—A support adapted to hold either of the hind hoofs of a horse in raised position for shoeing is illustrated by Fig. 5. The apparatus comprises a saddle; a lever; a collar, to engage with one end of the lever, and a foot-supporting attachment fastened to the other end of the lever.

LOCK FOR WEARING APPAREL—Devices of several kinds for locking umbrellas to hooks or umbrella stands in restaurants and like places, have made their appearance from time to time. Figure 6, however, shows a device for not only safeguarding the umbrella, but the outer coat and the hat as well. It comprises a rod adapted to pass through eyes or other openings in the articles to be locked, and a lock designed to cap one end, after the articles have been placed on the rod. The rod is attached to one end of a chain and the cap to the other.

BEDCLOTHES FASTENER (British patent)—Any person who has experienced the disagreeable sensation which results from pulling or kicking the bedclothes from under the mattress at the foot of the bed on a cold night, will appreciate the endeavor of the British inventor of the device shown in Fig. 7, to prevent such an experience. It consists of two strips of wood or other suitable material adapted to be bolted together to clamp the bedclothes at the foot.

GOLF-STROKE TEACHING APPARATUS (British patent)—An apparatus for teaching the correct swing with a golf club is shown in Fig. 8. It comprises an arm pivoting on a spindle and attached by straps to the shoulders of the player's body. It constrains the player's body to move, when making a stroke, about an imaginary line passing from a point near the crown of his head and emerging near the base of his spine. Both the height of the rod and the inclination of the spindle may be adjusted. A wall bracket may be used instead of the column to support the apparatus.

PRACTICAL OR UNIQUE

ROLLER POLE FOR ROLLER SKATERS—

When the very small boy who likes to play horse astraddle a broomstick becomes old enough to use roller skates, he may carry out the idea in a more practical way with a roller pole of the kind shown in Fig. 9. The device comprises a pole provided with a roller at one end, a seat near the center, a crosspiece for the hands at the other end, and a second crosspiece between the first mentioned crosspiece and the seat. This second crosspiece is to brace his knees against when he sits down on the seat after getting a good start.

MAGNIFYING GLASS FOR NEEDLE-THREADING (British patent)—The device shown in Fig. 10 is designed as an aid to the eyesight when it is necessary to thread a needle. It is a small magnifying glass which may be attached to the thumb by means of a spring clip, in the position shown.

RUBBER-PROTECTED NURSING BOTTLE—(British patent)—A boat-shaped nursing bottle protected by two large rubber rings projecting beyond the body of the bottle is illustrated in Fig. 11. The rings may be solid or hollow and are connected together by a sheath.

BOTTLE-RINSING FAUCET—Figure 12 illustrates a special cock arrangement for kitchen-sink faucets, the purpose of which is clearly shown. The bottle to be rinsed is slipped over the fixture and rests on a collar, in the sides of which portions are cut away to provide an escape for the water from the bottle.

PARACHUTE FIRE ESCAPE—Figure 13 is a curious parachute arrangement by means of which a person, shut off by fire or smoke from other ways of escape, is expected to drop to the sidewalk or ground in safety. The parachute apparatus is designed to be attached in operative position outside a window, the parachute being contained in a tubular protector. The person attempting to escape works himself to the outer edge of the window sill, places his arms through arm supports and slides off, the parachute opening to retard and brake the descent, so that the ground will be reached without any harmful shock.

DIVISIONAL TOOTHBRUSH—Figure 14 illustrates a toothbrush having its bristles arranged in different-sized tufts, so shaped as to reach every part of the surfaces of the teeth.

COAT-AND-SKIRT HANGER (British patent)—Coat hangers of many kinds and varieties have made their appearance on the market, but this hanger (Fig. 15) is a little different from others in that it is designed especially for women's wearing apparel and accommodates both the coat and skirt of a suit. The hanger comprises two hinged members, each of which is formed with two arms of different curvatures, the upper arms supporting the coat, and the lower arms, the skirt. The hanger may be folded about the hinge, which is just under the hook, and is prevented by stops from collapsing while in use.

ROLLER FLOUR CONTAINER—Figure 16 shows a rolling-pin flour container, the hollow body of which is perforated to allow a discharge of flour onto the surface over which the pin is rolled. One of the roller handles is also hollow, and in it is contained a dough knife.

SWIMMING MITT—A swimming mitt, having a body of a length and width to slip fairly closely over the four fingers of the hand, is shown in Fig. 17. The purpose of the mitt is to make possible a more effective stroke in swimming by preventing any flow of water between the fingers.

SHOE WITH COMBINATION ELASTIC AND LACED UPPER—A laced-upper shoe which may be drawn onto and removed from the foot without unlacing is shown in Fig. 18. The back portion of the upper is of elastic material, and around this passes a leather strap provided with a snap button, the purpose of the strap being to hold the upper snugly around the ankle. The strap may be unsnapped to ease the tightness of the shoe when the wearer is reclining in an easy-chair.



Fig. 9



Fig. 10

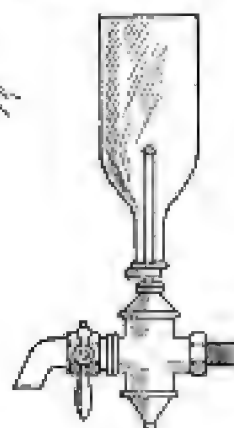


Fig. 11

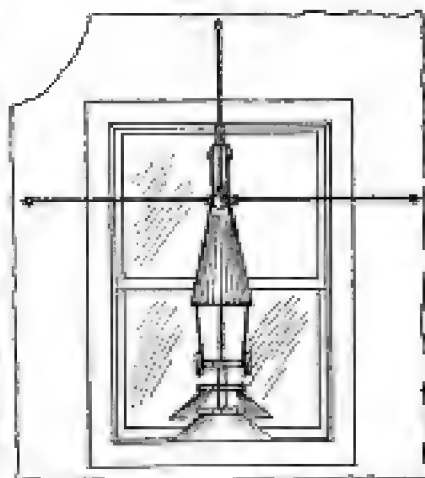


Fig. 12



Fig. 13

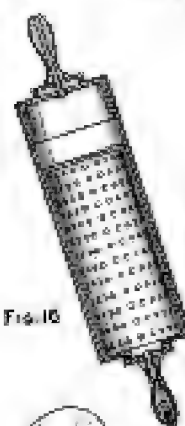


Fig. 14

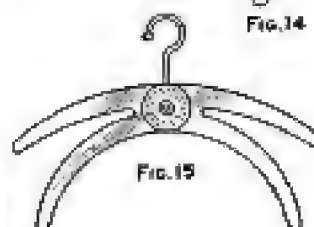


Fig. 15



Fig. 16

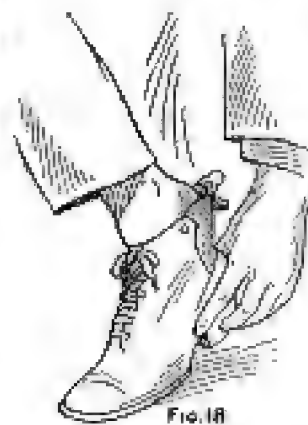


Fig. 17



Fig. 18

FOR the purpose of advertising fishing rods, a shopkeeper hung a large rod outside his shop, with an artificial fish at the end of it. Late one night Perkins, who had been dining a bit too well, happened to see the fish. Going cautiously to the door, he knocked gently.

"Who's there?" demanded the shopkeeper from an upper window.

"Sh-h! Don't make a noise, but come down as quietly as you can," whispered Perkins. Thinking something serious was the matter, the man dressed and stole downstairs.

"Now, what is it?" he inquired.

"Hist!" admonished Perkins. "Pull in your line, quick; you've got a bite."

"Mighty mean man I's wukin' fer."

"What's de mattah?"

"Took de laigs off de w'celbarruh so's I kaint set it down an' rest."

Recently in Seattle in a cigar-stand appeared the sign, "We give \$15.00 for 1909 Lincoln pennies." No less a person was attracted by this than Judge Watson. He walked up to the counter and laying down a penny triumphantly asked for \$15.00. The clerk took the penny, examined it closely, asked if it were genuine, and after several minutes sighed and said he guessed it was good.

"Certainly it is," answered the Judge. "Where is my \$15.00?"

"Where," said the clerk, "are the other 1909?"—*Life*.

He had dropped a nickel in the slot of a telephone pay station and stood patiently waiting. He was full to the brim. He read the instructions and took down the receiver.

"Number?" asked central.

"Five centsch."

"What do you want?"

"Spearmint."

A Harvard professor, noted for his severe way of examining students, tackled a raw-looking freshman: "I understand you attend the class for mathematics?" "Yes." "How many sides has a circle?" "Two," said the student. "Indeed! What are they?" "An inside and outside!" was the prompt reply. "And you attend the moral philosophy class also?" "Yes." "Well, no doubt you heard lectures on various subjects. Did you ever hear one on cause and effect?" "Yes." "Does an effect ever go before a cause?" "Yes." "Give an instance!" "A barrow wheeled by a man!" The doctor hastily sat down and put no more questions.

A Texan and a New Yorker were one day discussing the relative merits of their respective climates. "Down where I live," said the Texan, "we grew a pumpkin so big that when we cut it my wife used one-half of it as a cradle to rock the baby in."

The New Yorker smiled. "Why, my dear fellow," he said, "that's nothing at all. A few days ago, right in New York City, three full-grown policemen were found asleep on one beat."

A new book of memoirs in England recalls what has been styled the most brilliant epigram ever written. It was written by one J. K. Stephen, Cambridge undergraduate, about a stout professor, Oscar Browning:

KINDLY WARNING TO A FAT MAN,

O. B., oh, be obedient

To Nature's stern decrees;

For, tho you be but one O. B.,

You may be too obese!

"Bill's goin' to sue the company for damages."

"Why? wot did they do to 'im?"

"They blew the quittin' whistle whin 'e was ear-ryin' a 'eavy piece of iron and 'e dropped it on 'is foot."—*Domestic Engineering*.

He had been to Europe and returned, and he was telling a friend on the car what he had seen, when a man with red eyebrows leaned across the rail and said:

"I beg your pardon, sir, but I should like to butt in. You have been to Europe?"

"Yes, sir."

"They knew you were an American?"

"They did."

"You talked with many men?"

"A great many."

"Did any of them refer to the political corruption in this country?"

"No."

"Nor to the cold-storage sharks?"

"No."

"The Beef Trust?"

"No."

"The coal robbers?"

"No."

"The extortion in express rates?"

"No."

"To the trusts in everything, even in coffins?"

"No."

"To the buying and selling of Senators?"

"No."

"Then, my sir, will you be kind enough to tell me in which direction Europe lies and how long it will take me to get there? I want to go there instead of to heaven."—*Rochester Democrat and Chronicle*.

Police Commissioner—If you were ordered to disperse a mob, what would you do?

Applicant—Pass around the hat, sir.

Police Commissioner—That'll do, you're engaged, sir. Iathinder.

The Visitor—Why are you here, my misguided friend?

The Prisoner—I'm the victim of the unlucky number 13.

The Visitor—Indeed; how's that?

The Prisoner—Twelve jurors and one judge.

Mrs. Bacon: "She's one of the most obstinate women I ever knew."

Mrs. Egbert: "Indeed?"

Mrs. Bacon: "Yes; why, I believe if she took laughing-gas she'd cry!"

NEW BOOKS

THE PRIMER OF HYDRAULICS—By Fred-erick A. Smith, Hydraulic Engineer, is a commendable work for anyone interested in the subject. The beginner, without any but a grammar-school education, will find in the first nine articles a clearly written, and easily understood introduction into the mathematical principles and methods, which must be comprehended, before the practical problems are approached; and the full-fledged hydraulic engineer will also find much in the work of great value to him in the use of the tables and methods of analysis contained therein. The book is fully illustrated and contains, besides an alphabetical index, all the tables required to solve working problems. 215 pages, 5x7½, cloth, \$2.50. D. H. Anderson, Chicago.

INTRODUCTION TO ANALYTICAL MECHANICS—By Alexander Ziwet, Prof. of Mathematics, and Peter Field, Ph. D., Assistant Prof. of Mathematics, in the Univ. of Michigan. A brief introduction to mechanics for junior and senior students in colleges and universities, without applications to engineering. The nature and purpose of the work have made it necessary to omit many important subjects, but the selection made seems, on the whole, fortunate, and well adapted to give the reader a general view of the science of mechanics as a whole, and a broad enough foundation for further study. 378 pages, 5x7½, cloth, illustrated and indexed. Price \$1.00 net. The Macmillan Company, New York and London.



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MONOGRAMS engraved as above cost from \$2.50 to \$3.50, sometimes more at a jeweler's. But in connection with our anti-trust price offer we are engraving monograms at \$10 each, French and dragons \$1.00, etc. Write for catalog to get details. The movements in these watches are guaranteed the best, equal or superior to those of watches regularly sold at three times the price by trust goods dealers—yes three times the price. Every movement is

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Adjusted to Temperature The watch is put into a refrigerator and run for twenty-four hours, then it is put into an oven of 110 degrees temperature and run for twenty-four hours, then it is run in normal temperature for twenty-four hours. This process is continued until the watch runs the same in all temperatures. **Not 10 in 100 watches, i. e. not 10% even of the better grade watches are adjusted to temperature.**

Adjusted to Positions Adjusting a watch to positions is adjusting it so it runs the same in various positions. **Not one watch in 200; that is, less than 1/2 of 1% of even the better grade of watches are adjusted to positions. Only the Very Best.**

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English Branches
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The Right of All the Way

Railroad service and telephone service have no common factors—they cannot be compared, but present some striking contrasts.

Each telephone message requires the right of all the way over which it is carried. A circuit composed of a pair of wires must be clear from end to end, for a single conversation.

A bird's-eye view of any railroad track would show a procession of trains, one following the other, with intervals of safety between them.

The railroad carries passengers in train loads by wholesale, in a public conveyance, and the service given to each passenger is limited by the necessities of the others; while the telephone carries messages over wires devoted exclusively for the time being to the individual use of the subscriber or patron. Even a multi-millionaire could not afford the exclusive use of the railroad track between New York and Chicago.

But the telephone user has the whole track and the right of all the way, so long as he desires it.

It is an easy matter to transport 15,000 people over a single track between two points in twenty-four hours. To transport the voices of 15,000 people over a single two-wire circuit, allowing three minutes for each talk, would take more than thirty days.

The telephone system cannot put on more cars or run extra trains in order to carry more people. It must build more telephone tracks—string more wires.

The wonder of telephone development lies in the fact that the Bell System is so constructed and equipped that an exclusive right of all the way, between near-by or distant points, is economically used by over 24,000,000 people every day.

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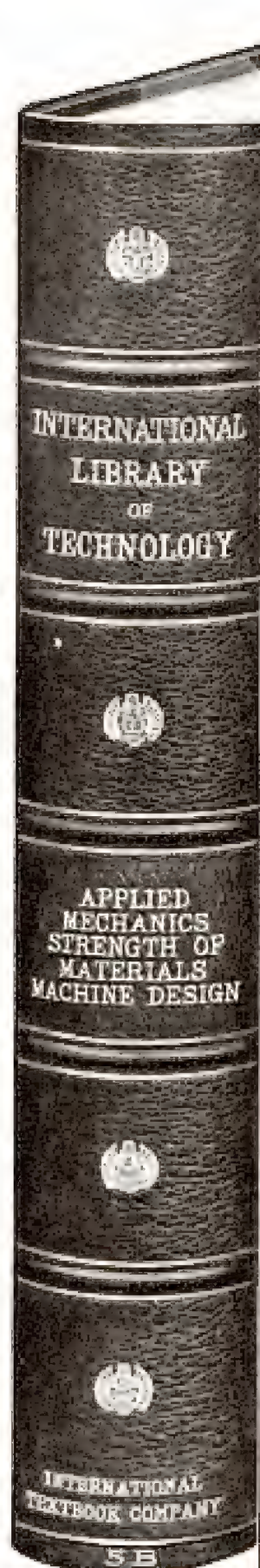
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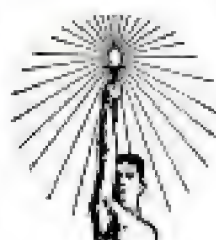
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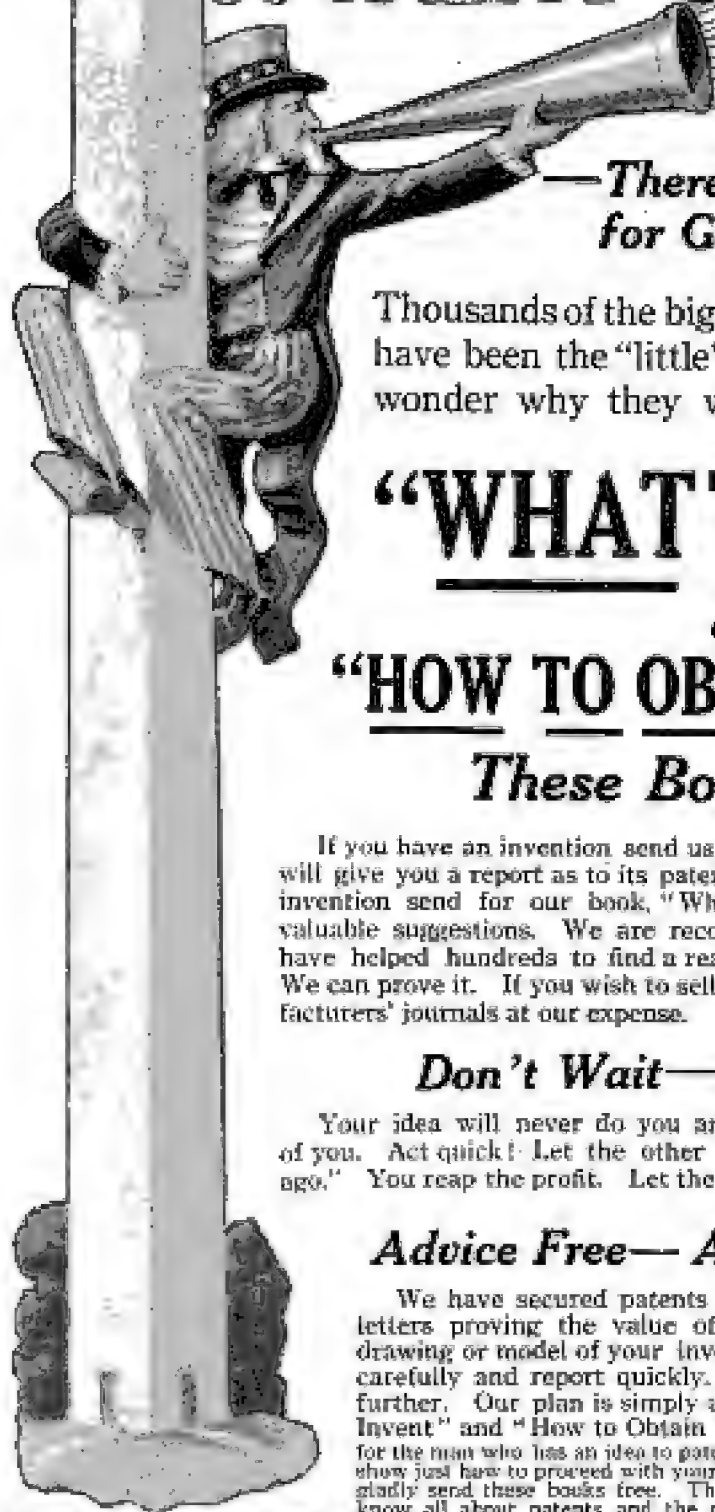
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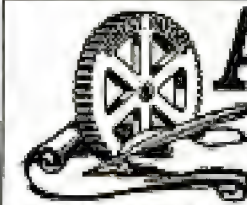
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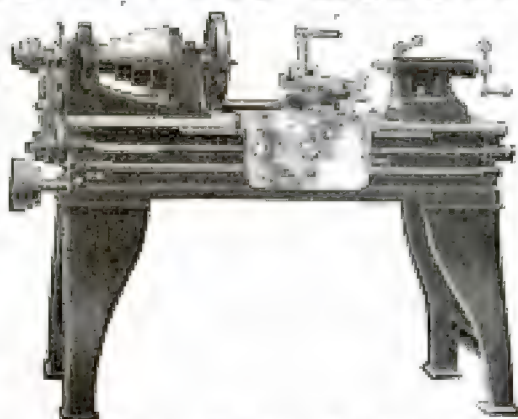
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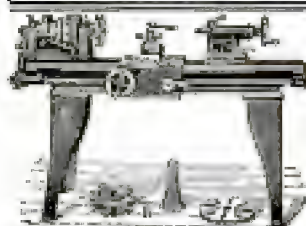
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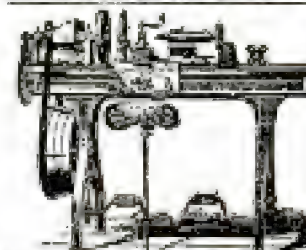


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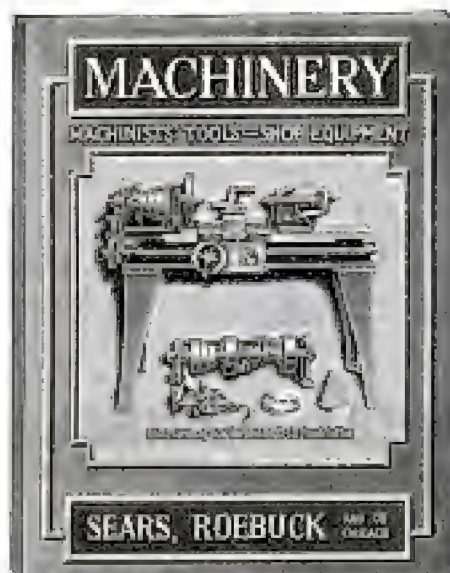
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Improved construction, absolutely perfect, runs your washing machine and a hundred other things. Power for small tools. $\frac{1}{4}$ horse power on $\frac{1}{2}$ -inch pipe, 80 pounds pressure; 1 horse power on 2-inch pipe, 60 pounds pressure. New net price, \$5.00 cash with order.

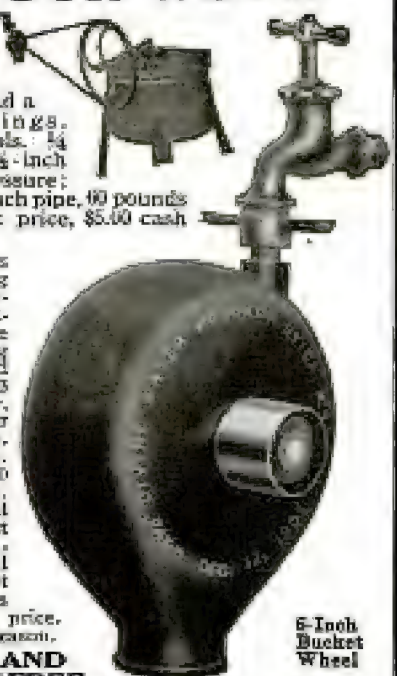
No. 1492 4-inch Motors for grinding, polishing and buffing. Runs sewing machines, fans, bottle washers, etc. Price with emery, buffing wheel, silver polish and pulley, \$1.00. No. 1493 Motor and pulley only, \$2.50. $\frac{1}{4}$ horse power on 3/8 inch pipe, 80 pounds pressure. Improved construction. Speeds, 1,000 to 3,000 revolutions per minute. Only scientifically and mechanically perfect small water motor manufactured. Patented construction makes it possible. Tremendous output warrants the price. Money back for any reason.

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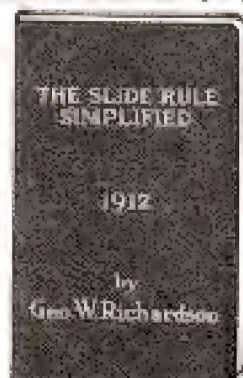
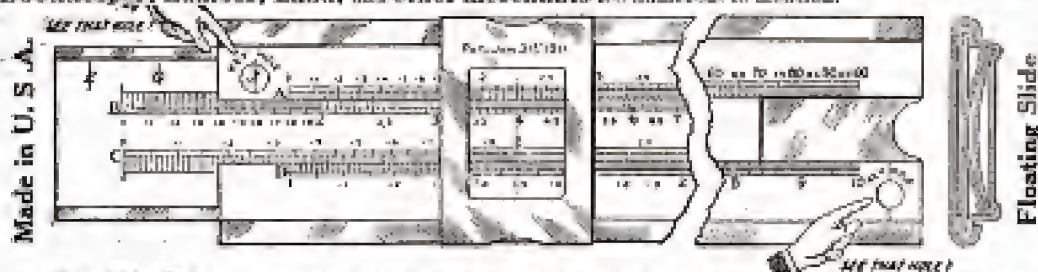
For the name of your local hardware or tool dealer, we will send you free booklet on "Theory and Design of Water Motors."



6-Inch Bucket Wheel

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There seems to be a misunderstanding about what the Slide Rule will accomplish. Many think it an instrument, the use of which is applicable only to Engineers and Technical men. So frequently have I heard this remark that I have completely re-written and enlarged my instruction book, which shows the actual setting of the rule by 70 full size engravings, each engraving and example is explained and "written so you can understand it." In fact any person who has never seen a Slide Rule, and not a technical person, could not help but learn its use. The examples selected and shown by illustrations are those which frequently come up for solution by the Banker, Broker, Auditor, Inventory Man, Cost Estimator, Printer, Paper Mfr., Contractor, Salesman, Time-Keeper, Bookkeeper, Lumber, Land, and other merchants too numerous to mention.



This Slide Rule will multiply, divide, solve proportion, extract the square and cube roots, find the decimal equivalent of vulgar fractions or "vice versa," calculate interest, percentage. Also the mensuration of superficies, and the rule of three. For Engineers, Electricians, Draftsmen, Superintendents, Master Mechanics, etc., the rule is indispensable in their work. It is one of the most valuable instruments ever offered to mankind. For Electricians it is a complete wire table in itself, calculates the size of a motor to run a pump, shows percentage a customer's recording meter is either "slow or fast." The Richardson Direct Reading Slide Rule is specially designed for those who wish to learn its use. Its operation being very simple. You simply place the key to the problem wanted in the keyhole (this key is printed in red on slide, see cut) and answer is given direct: such as the Horse Power of Engines, Pumps, Rollers, Belts, Water Falls; size of duct for ventilating, radiation and size grate, and steam main required; change gear and pulley problems; areas, circumference and diameter of circles. This Rule is my 1912 type now being placed on the market for the first time. Made in two sizes, coat and vest pocket 11x1 1/2" and 5x1 1/2". No wood in their construction, scales white celluloid, printed from engine divided plates in two colors, and washable, secured by an improved locking device in an absolutely non-corrodible Aluminum and Monel Metal framing. Durable cardboard case for large rule, and neat leather case for vest pocket size. Special case for large rule end-cap and button fastening 25c extra. If ordered now I give free a copy of my new book *The Slide Rule Simplified* containing over 70 full size engravings showing just how to set the rule with explanation. Price of either rule \$2.50. Price of book without rule, paper cover \$1.00. Flexible silk cover \$1.50. GEO. W. RICHARDSON, Consulting Engineer, Ex-Chief Electrician U.S. Navy, 4218 24th Pl., Chicago, U.S.A.

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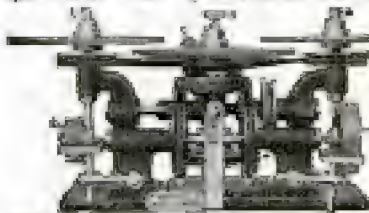
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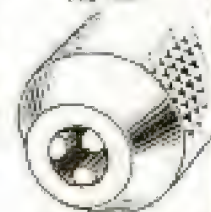
Slips into the pocket



Handle is magazine for points



Weights but 1½ lbs.



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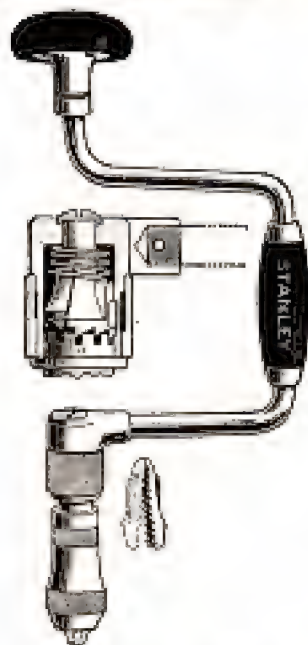


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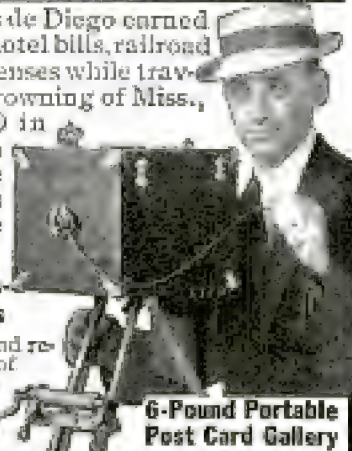
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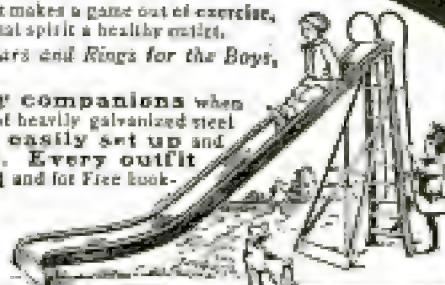
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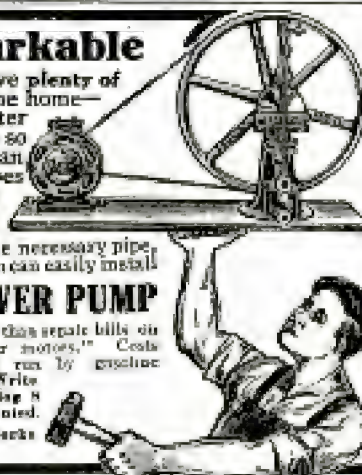
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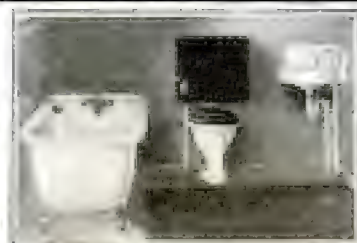
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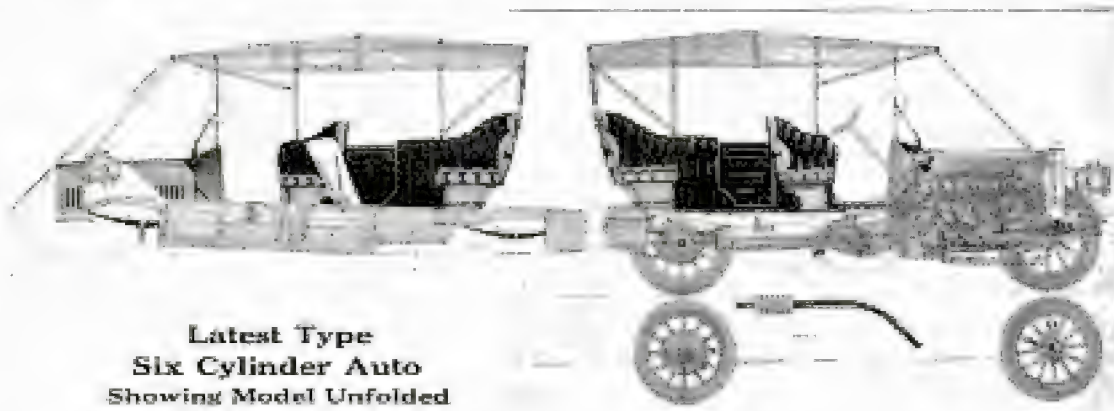
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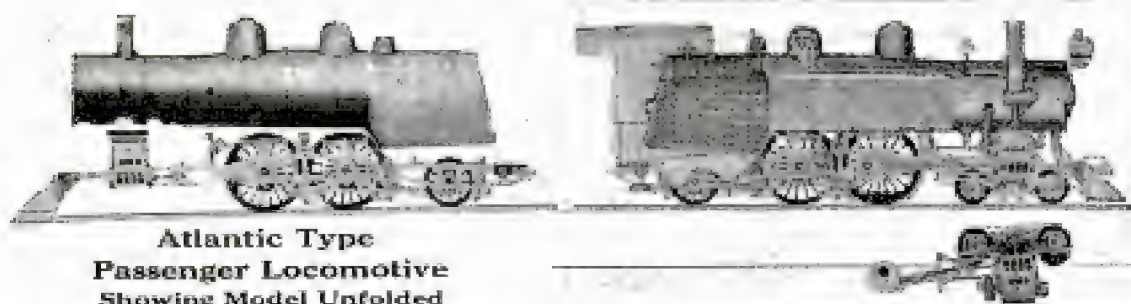
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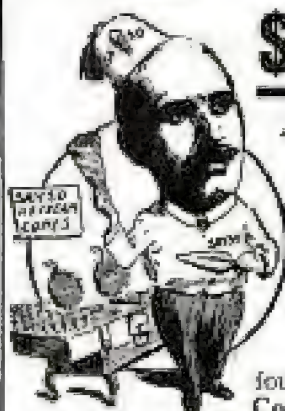
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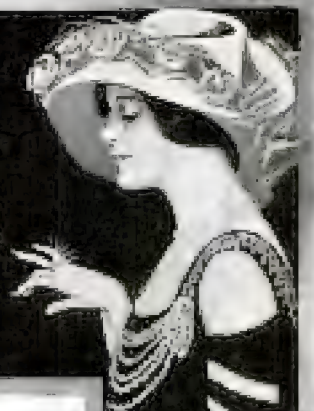
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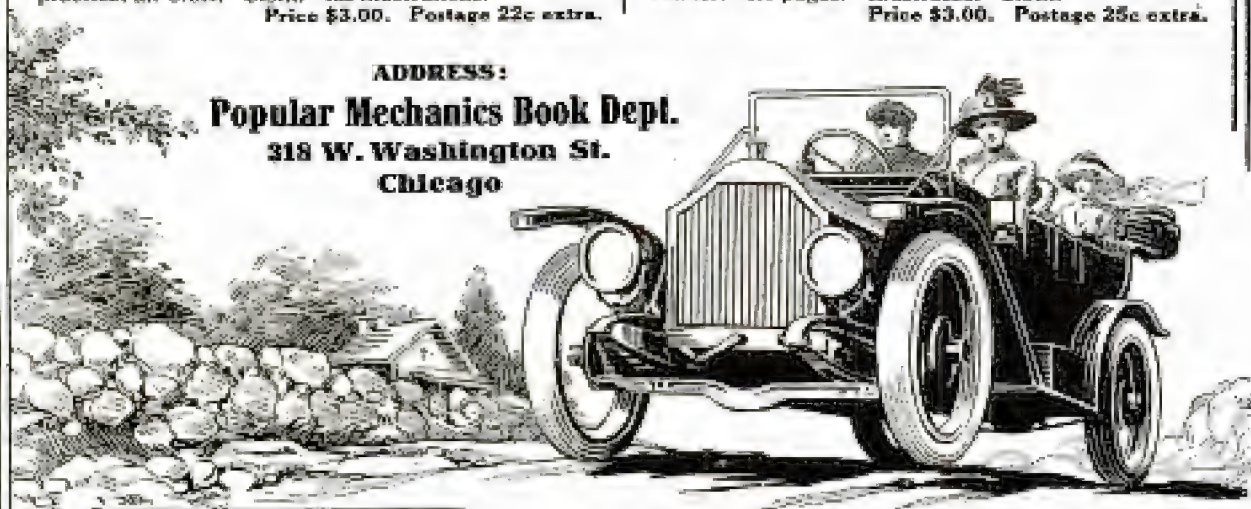
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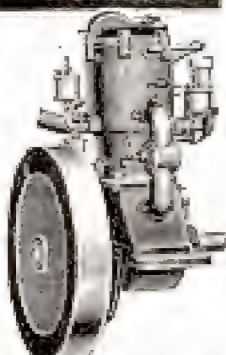
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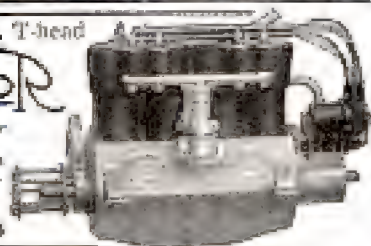
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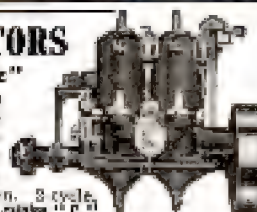
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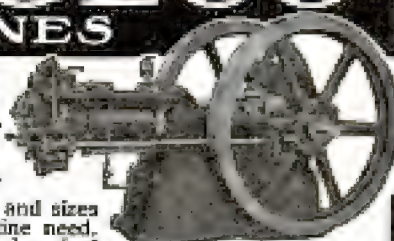
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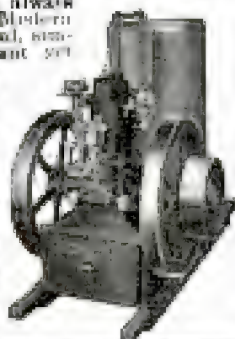
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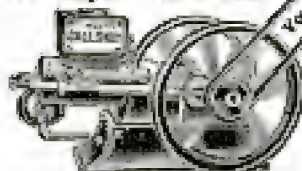


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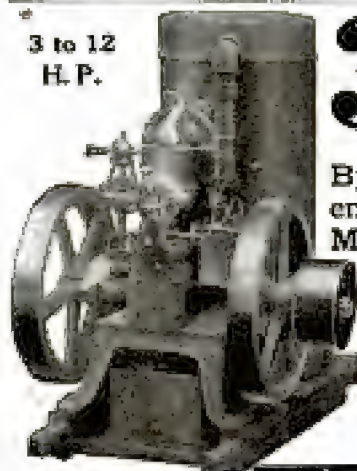


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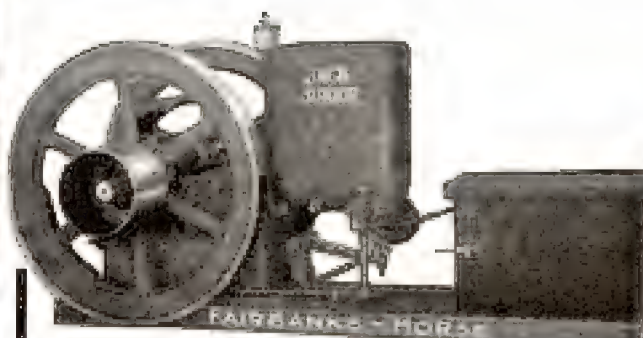


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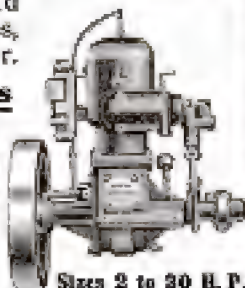
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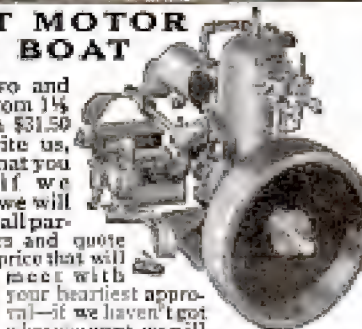
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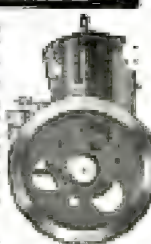


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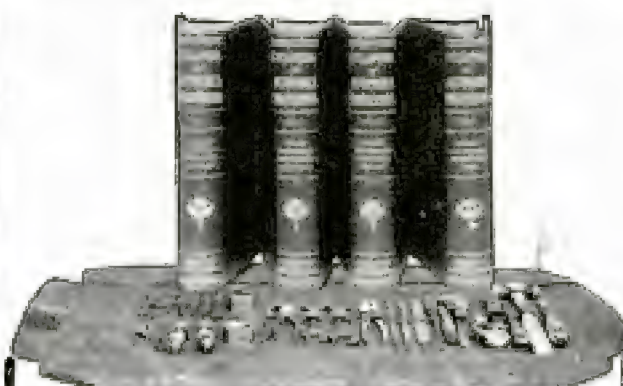
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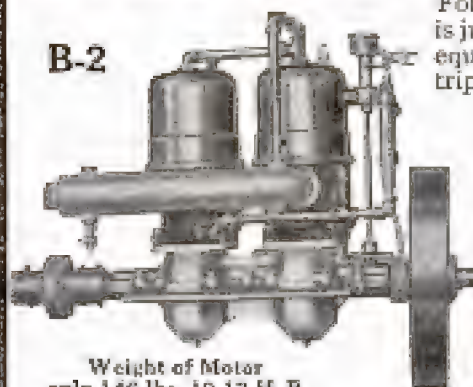
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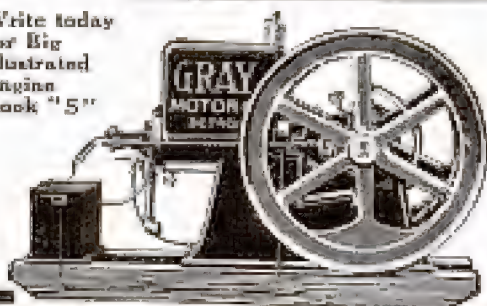


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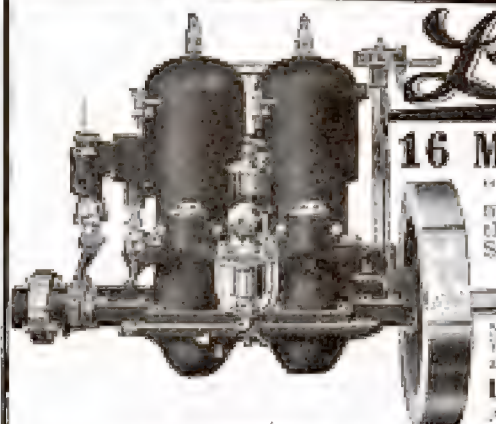


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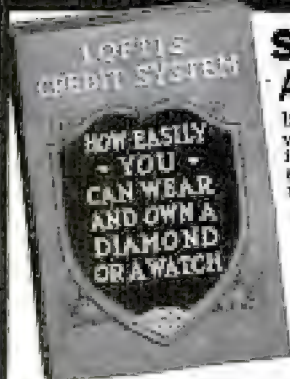
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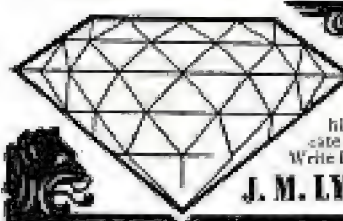
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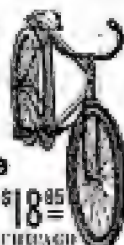


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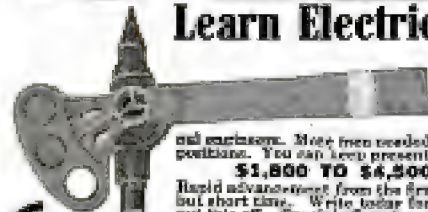
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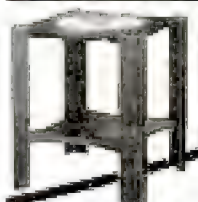
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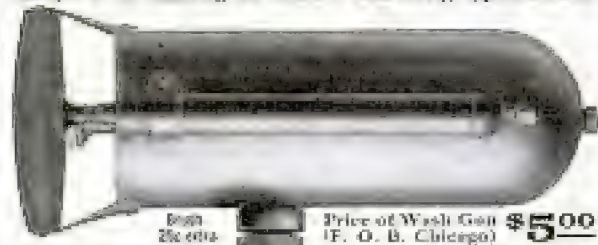
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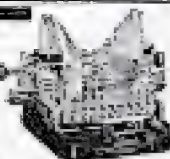
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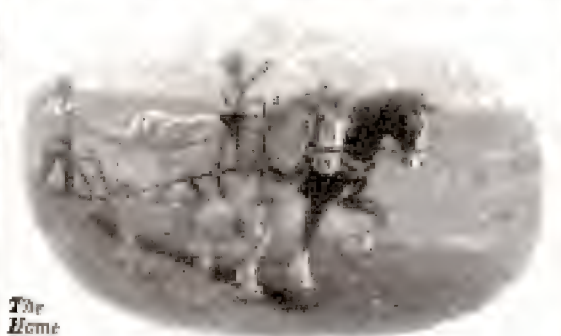
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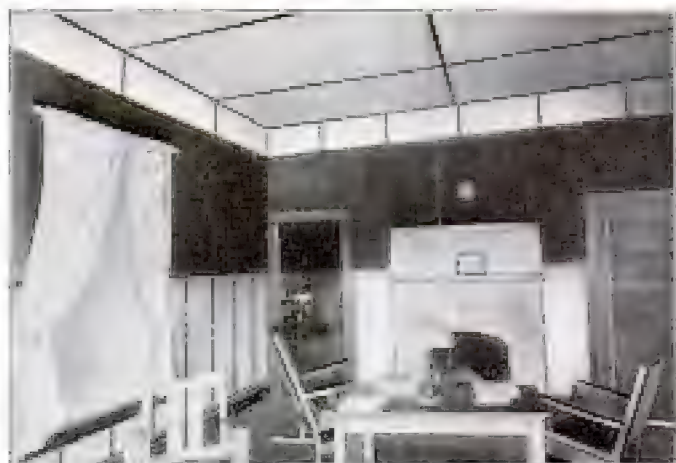
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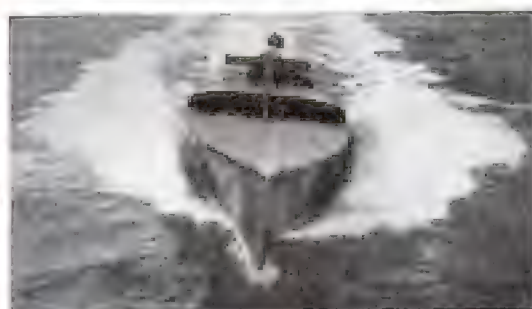
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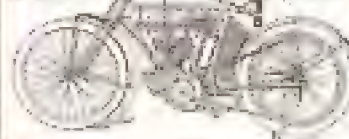
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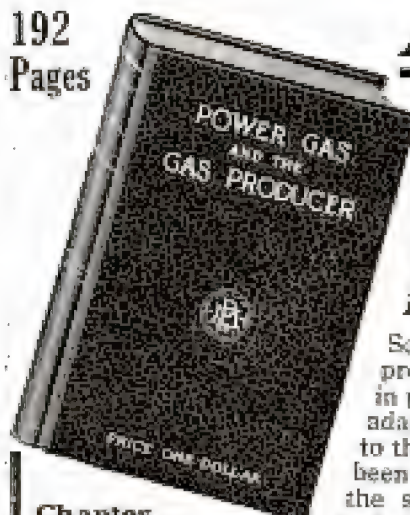
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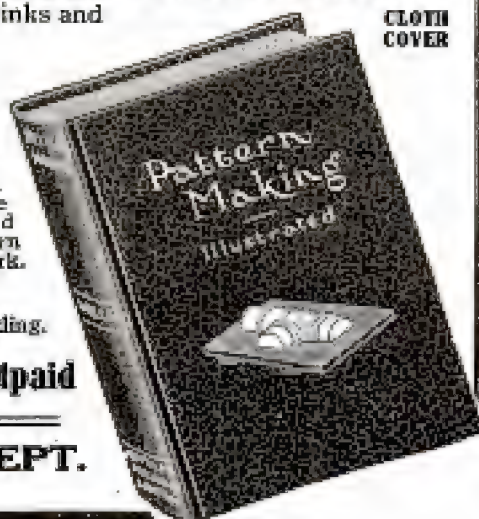
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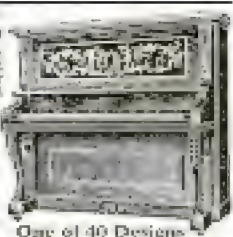
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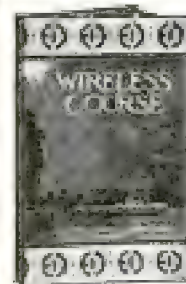
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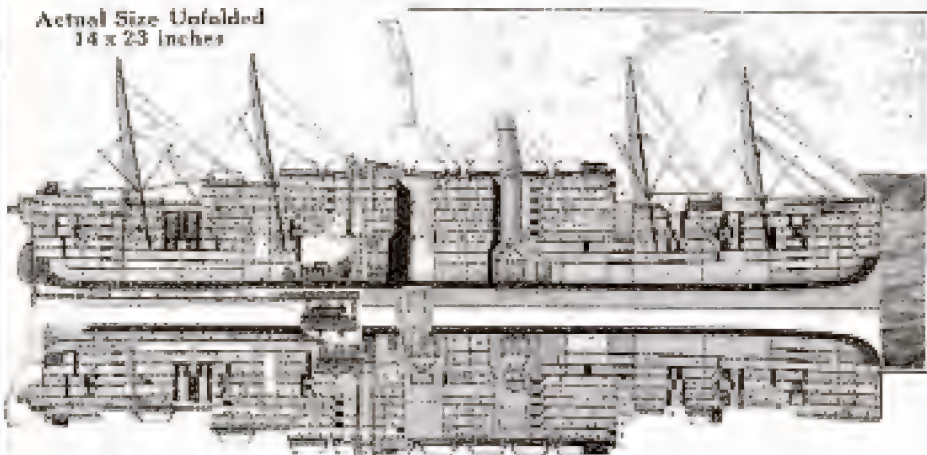
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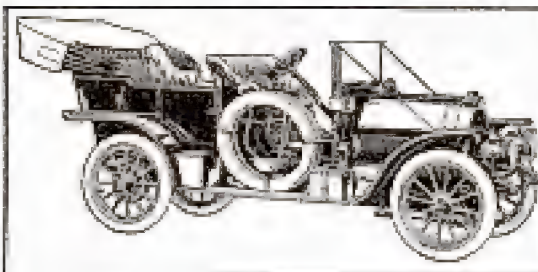
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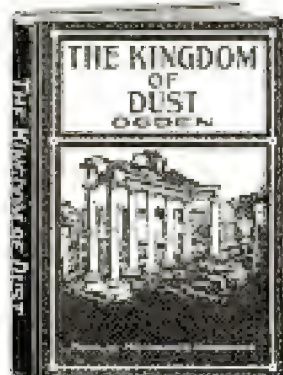
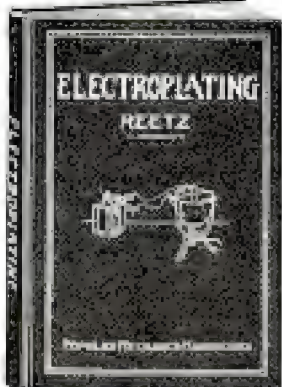
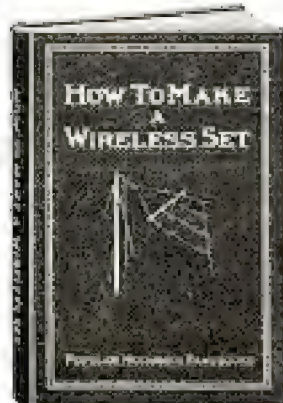
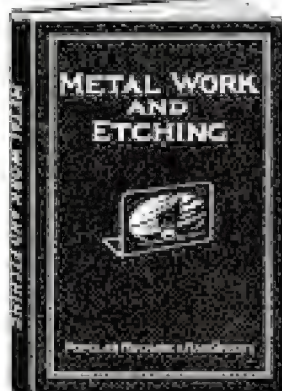
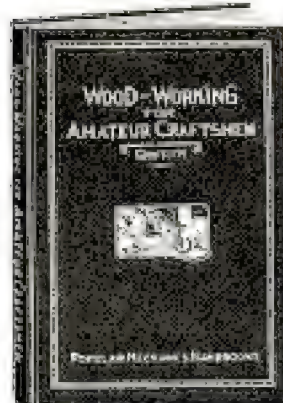
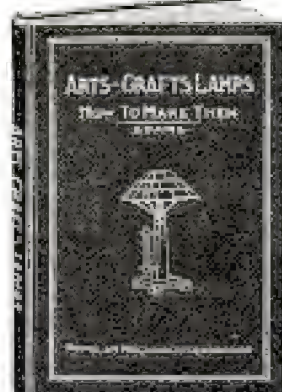
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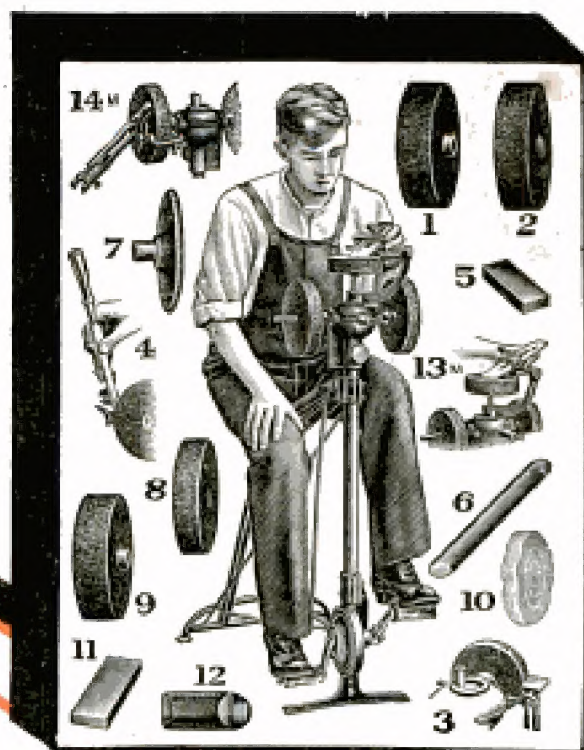
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